West Bengal State Electricity Distribution Company Limited

(A Govt. Of West Bengal Enterprise)

TECHNICAL SPECIFICATION FOR 10 MVA & 6.3 MVA POWER TRANSFORMER

FEBRUARY'2025

WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED
TECHNICAL SPECIFICATION FOR 10 MVA & 6.3 MVA POWER TRANSFORMER

1.00 SCOPE OF SPECIFICATION:

1.01 This specification is intended to cover design, manufacture, assembly testing at manufacturer's works, supply and delivery upto placement on plinth of three phase 50HZ, 33/11 KV Delta/ Star, Vector Group DYn 11, two windings copper wound outdoor type, oil immersed, ONAN Power Transformer with on load tap changer for 10MVA and 6.3 MVA Power transformer along with OLTC and SCADA compatible RTCC panel as per detail furnished hereafter.

1.02 The transformer offered shall be complete with all parts and accessories which are necessary for their efficient and satisfactory operation. Such parts and accessories shall be deemed to be within the scope of this specification whether specifically mentioned or not. Main tank body may be delivered in unpacked condition, but delicate parts like indicating meter, radiator, conservator; Pressure Relief Valve, equalizer pipe, buchholz relay etc. shall be packed to avoid damage due to transshipment.

2.00 LOCATION:

2.01 The transformer shall be installed outdoor anywhere in West Bengal. The elevation of sites above mean sea level is not likely to exceed 1000meter.

3.00 SYSTEM DETAILS

3.01 33 KV system is non-effectively earthed through earthing transformer, whereas 11 KV system is to be effectively earthed at neutral point of the star connected windings of the power transformer.

System voltage is subject to fluctuation of 10% of nominal voltage. Maximum system voltage for 33 KV and 11 KV system shall be taken as 36 KV & 12.0 KV respectively. The frequency for the purpose of this standard shall be 50HZ with tolerance of ± 3 %.

4.00 WEATHER CONDITION:

For the purpose of designing, the following condition shall be considered:

A) Elevation about Mean sea level	: 1000M.
B) Maximum Ambient Air Temperature	: 50 Deg. C.
C) Maximum daily Average Ambient Air Temperature	: 40 Deg. C.
D) Minimum Ambient Air Temperature	: 0 Deg. C.
E) Maximum Humidity	: 100%
F) Average number of thunderstorm, day per annum	: 100
G) Number of months of tropical monsoon	: 4-5
H) Average Annual rainfall	: 3000 mm.
I) Maximum wind pressure	: 100 Kg. Per sq.m.

5.00 APPLICABLE STANDARDS

5.01 Unless otherwise stated, transformer shall be designed, constructed and tested in accordance with provisions contained in latest revisions of following Indian standards and Rules.

i. IS : 2026

ii. R.E.C. Manual 10/1976

iii. C.B. I.P. Manual on Transformer

Technical Report 1: Section : A.D. (Revised: 1987)

iv. C.B.I.P. Technical Report No. 72 (June: 1989)

v. Indian Electricity Rules, 1956 (Amended up to date)

vi. IS : 2099 Bushing for alternating voltage above 1000 volt

vii. IS : 6600 Guide for loading of oil immersed transformer

viii. Specification for Transformer oil (IS-335 & IS-1866,1983)

ix. Other applicable Indian Standards.

DEVIATION FROM SPECIFICATION

6.00 Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve utility, performance and efficiency of equipment or to secure overall economy shall be mentioned in the 'Schedule of Deviations" with full justification, supported by documentary evidence. Such deviations, suggested, may or may not be accepted. But deviations, not mentioned in the "Deviation Schedule" will not be considered.

7.00 RATING AND GENERAL PARTICULARS:

7.01 Type:

Stack Core type, three phase, oil immersed, step down, two winding copper wound transformer for outdoor installation.

7.02 Standard Rating:

Continuous with On load circuit taps as mentioned in the schedule of requirement.

7.03 Continuous Maximum Rating and Temperature rise:

As regards maximum rating and temperature rise, all transformers shall comply with the appropriate requirement of Indian Standards.

For the purpose of consideration of maximum temperature rise of oil and winding, the following ambient temperatures are assumed.

i) Cooling medium: Air

ii) Maximum Ambient Air temperature: 50 Deg. C.

iii) Maximum daily average ambient Air temperature: 40 Deg. C.

iv) Maximum yearly weighted average temperature: 32 Deg. C.

With the above ambient temperature condition allowable maximum temperature rise shall be as mentioned below:

a)	Type of Cooling	:	ONAN
b)	Maximum top oil temperature rise in Deg. C	:	50
c)	Maximum Winding temperature rise in Deg. C	:	55
d)	Maximum Winding temperature in Deg. C	:	105
e)	Maximum Permissible value of Average temperature of winding after 2 sec of short circuit in Deg C.	:	250

7.04 No load voltage Ratio

The no load voltage Ratio corresponding to principal (normal) tapping shall be 33,000/11,000 Volts.

7.05 Winding connections and Vector Group etc.:

i)	Number of phases	:	Three
ii)	Frequency	:	50
iii)	Type of Cooling	:	ONAN
iv)	Winding connections	:	The primary winding (HV) shall be connected in delta and secondary winding (LV) shall be connected in star.
v)	Vector Group	:	Windings shall be connected as per Vector symbol : DYn11
vi)	Neutral Earthing	:	The neutral point of Secondary (LV) winding shall be brought out to a separate insulated terminal and shall be solidly earthed.

On Load Tap Changer applicable for 10 MVA and 6.3MVA transformer including RTCC panel.

This shall be designed suitable for local manual as well as local electrical operation and Remote electrical operation including SCADA operation with provision of master follower scheme for parallel operation. The OLTC shall be housed in a separate tank so that oil of the OLTC chamber does not come in contact with the oil of main tank in any way. There should be separate conservator with the arrangement of having the dehydrating breather for OLTC tank.

7.06 On Load Tap Changer

(1) The on load tap changer shall include the following–

(a) An oil immersed tap selector and arching switch or arc suppressing tap selector, provided with reactor or resistor for reduction of make and break arcing voltages and short circuits.
(b) Motor driven mechanism.
(c) Control and protection devices.
(d) Local/Remote tap changer position indicator.
(e) Manual/Electrical operating device.
(f) Voltage tapping range on H.V. side will be (+5%) to (-15%) in steps of 1.25%.

(2) **(a)** The on-load tap changer shall be designed so that the contacts do not interrupt arc within the main tank of the transformer. The tap selector and arcing switch or arc suppressing tap selector switch shall be located in one or more oil filled compartments, The compartment shall be provided with oil surge relay. Those compartments shall be designed so as to prevent the oil in tap selector compartments from mixing with the oil in the transformer tank.

(b) A suitable pressure relieving arrangement should be provided to take care of sudden

pressure rise in the compartment. But this should, in no way, affect the performance of the Oil Surge relay provided for this compartment. Oil surge relay (0.49 kg/cm².) with trip float arrangement shall be provided for OLTC compartment.

(c) The tap changer shall be capable of permitting parallel operation with either existing or future transformers of the same type as Master or Follower.

(d) The manual operating device shall be so located on the transformer that it can be operated by a man standing at the level of the transformer track. It shall be strong and robust in construction.

(e) The control scheme for the tap changer shall be provided for independent control of the tap changers when the transformers are in independent service. In addition, provision shall be made so that under parallel operation the tap changer will give alarm and visual indication for becoming out of step. Visual indication during the operation of motor shall also be incorporated. The control scheme of the tap changer of the existing transformer to run in parallel will be furnished to the successful bidders, if required. The tap change control must ensure step by step operation under all operating conditions.
Necessary interlock blocking independent control when the units are in parallel shall be provided.

(f) Under parallel operation, as may occur if the contactor controlling one tap changer sticks, the arrangement must be such as to switch off supply to the motor so that an out of step condition is limited to one tap difference between the units. Details of out of step protection provided for the taps shall be furnished in the bid.

(g) The contactors and associated gear for the tap change driving motors shall be housed in a local kiosk mounted on the transformer. The motors shall be suitable for operation with 3- phase 400 volts, 50 cycle external power supply.

7.07 Remote Tap Changer Control Panel

A) The supplier shall furnish, in addition to the equipment above, the following accessories mounted on a separate Remote Tap Changer Control (RTCC) panel to be installed in each of the WBSEDCL's Control Room for remote operation.

i) Raise and Lower Push Button Switch

ii) Remote tap position indicator and other required devices. One chart showing the voltage corresponding to tap position indicator shall be engraved on a metal sheet and the same shall be fixed near the tap position indicator on the RTCC (panel).

iii) An indication lamp showing tap changing in a progress

iv) Master, Follower and Independent selecting switch and other accessories required for complete operation of tap changer.

v) Name plate of each component

vi) Winding & Oil temperature (O degree – 150 degree) repeaters, to be connected to winding and oil temperatures meters housed in the main Transformer Marshalling Box at outdoor.

vii) Provision for SCADA operation(Please see enclosed Annexure-B)

viii) An under voltage relay shall be incorporated to monitor the 110 Volt AC control circuit voltage circuit supply Similarly audible and visual indication shall be provided in RTCC panel.

The OLTC should have been Type Tested.

7.08 Impedance Value:

The percentage impedance at 75 Deg.C & 50 HZ refer to the (normal) principal tapping shall be as follows:

Sl. No.	Rating	Voltage Ratio	% Impedance
1.	6.3MVA	33/11 KV	7.15
2.	10MVA	33/11 KV	8.35

The impedance value referred to the (normal) principal tapping are subject to a tolerance ±10%.

7.09 Losses :

Standard losses at 75 Deg.C will be as follows:

Sl.No	Rating	Voltage Ratio	No load loss (KW) at 50 Hz	Full load loss (KW) at rated full load current at 75°C
1	6.3MVA	33/11 KV	4.6	36
2	10 MVA	33/11 KV	7	50

Tolerance of losses shall be guided by the relevant clauses of relevant IS standard.
The bidder shall state both no load loss and load loss at rated voltage & frequency and loss figures shall be firm and guaranteed.

7.10 Evaluation of Losses:

i) The bidder shall state the transformer losses viz. iron (core) and copper loss. The iron loss (no load loss) in KW at rated voltage and at rated frequency, and load losses (Copper loss) in KW at rated full load capacity and at rated voltage and frequency shall be guaranteed at 75 deg. C.

ii) For the purpose of comparison of bids, the capitalised cost of iron loss (KW) and load losses (KW) shall be added to the quoted price of transformer at the following rates.

- Capitalised value of iron loss per KW – Rs. 6,68,304.00
- Capitalised value of copper loss per KW – Rs. 2,00,492.00

iii) No bidder shall specify any tolerance limit in respect of these losses.

iv) If any or all actual losses after test are found to exceed the guaranteed value as declared by the respective bidder but within the values as specified in the WBSEDCL specification, the penalty will be imposed on the excess loss over the corresponding guaranteed loss (any or all). The penalty shall be calculated for the excess of no load loss and for the excess of the load losses at rates specified above. For fraction of a KW, the penalty shall be applied on prorata basis. If the test figure of losses are less than the guaranteed value, no bonus will be allowed. Any changes in the figure assigned for transformer losses will not be permitted after opening of bids and bid evaluation will be carried out on the basis of information made available at the time of bid opening.

7.11 Terminals :

Transformer shall be provided with bushing insulators on both H.V and L.V. sides. H.V and L.V. bushings shall be located on opposite side.

The electrical characteristics of bushing insulator shall be in accordance with IS: 2099. Dimensions and type of bushing shall conform to IS: 3347 and shall be as follows:-

H.V. Bushing (33KV Side)	36KV Class	Porcelain bushing with plain sheds for heavily polluted atmosphere.
L.V. Bushing (11KV Side)	12 KV Class	Porcelain bushing with plain sheds for heavily polluted atmosphere.
Neutral Bushing	Neutral of L.V. winding shall be brought out through porcelain bushing similar to L.V. Bushing for connection with earth terminal in line with LV bushing.	

Provision of Current Transformer in L.V. side of Power Transformer

In order to achieve Restricted Earth fault in star connected L.V. Side of Power Transformer, current transformer having following particulars shall have to be provided between neutral lead beneath the neutral bushing of L.V. side of both 6.3 & 10.0 MVA Power Transformers and in case of 10 MVA current transformers C.T.s are to be provided beneath the bushing of the leads of r, y b phases in order to achieve restricted Earth Fault or differential protection.

In order to provide the C.T.s suitable turrets with cover having Nut & bolt arrangement are to be provided on neutral of L.V. bushing for 6.30 MVA and for 10 MVA same arrangement of turrets are to be made on all the r, y, b & neutral bushing of L.V side.

The technical specification of the C.T. for 6.30MVA & 10.00 MVA Power Transformers should be as follows:

CT Particulars	For 6.3 MVA Transformer	For 10 MVA Transformer
i) Type :	Suitable for installation in L.V. side of Power Transformer for REF protection	Suitable for installation in L.V. side of Power Transformer for REF protection/Differential Protection
ii) Ratio :	400/1A at Neutral side	600/1A at all phases and Neutral
iii) Accuracy Class :	PS.	PS.
iv) Knee Point Voltage Vk :	Vk > 250 volt	Vk > 250 volt
v) RCT at 75 Deg. C at Lower & Higher Taps. :	RCT <4 Ohm at 75 Deg.C and	RCT <4 Ohm at 75 Deg.C
vi) Magnetizing Current at knee point voltage :	< 30 mA at VK	< 30 mA at VK
vii)Additional winding for testing of the C.T. :	Not required.	Not required.

8.00 SHORT CIRCUIT LEVEL:

8.01 Designed Maximum fault level of 33 KV and 11KV are 20KA and 16 KA respectively.

9.00 INSULATION LEVEL:

9.01 The transformer and bushing shall be capable to withstand test voltage as specified below:

Parameters	Transformer Winding		Transformer Bushing	
Nominal voltage (in KV r.m.s)	11	33	11	33
Highest voltage for equipment (in KV r.m.s.)	12	36	12	36

1.2/50 micro sec. impulse withstand voltage (in KV peak)	75	170	95	170
1 minute power frequency withstand voltage (in KV r.m.s.)	28	70	28	70
Minimum creepage distance (mm)	-	-	300	900
Minimum clearance (mm) : Phase to phase	255	350	-	-
Minimum clearance (mm) : Phase to earth	140	320	-	-

10.00 CORES:

The Transformer shall be of stack core type and the core shall be constructed from high grade cold rolled non-aging grain oriented silicon steel laminations having magnate/Carlite coating as insulation. Successful bidder will offer the core for inspection and/or approval by the purchaser during manufacturing stage.

Manufacturer's call notice for the purpose should be accompanied with the following documents as applicable as a proof towards use of prime core materials:

i) Invoice of the supplier
ii) Mill's Test Certificate
iii) Packing Lists
iv) Bill of landing
v) Bill of entry Certificate to Customs

10.01 Core materials shall be procured either from the core manufacturer or through their accredited marketing organization of repute.

10.02 Bidder should preferably have in-house Core cutting facility for proper monitoring and Control on quality.

10.03 The materials used for insulation shall have high inter lamination resistance and rust inhibiting property. It shall not have any tendency to absorb moisture or to react with insulating oil.

10.04 The assembled core shall be securely clamped on the limbs and yoke with uniform pressure so as to minimize noise emission from it.

10.05 The top main core clamped on the limbs and yoke with uniform pressure so as to minimize noise emission from it.

10.06 The top main core clamping structure shall be connected to the tank body by a copper strap.

The bottom clamping structure shall be earthed by one or more of the following methods

(i) by connection through vertical tie rods to thetop structure
(ii) by direct metal to metal contactwith the tank base by the weight of the core and windings,
(iii) by a connection to the top structure on the same side of core the main earth connection to the tank.

10.07 All parts of the cores shall be robust design capable of withstanding any shocks to which they may by subjected during lifting, transport, installation and service.

10.08 Adequate lifting lugs shall be provided to enable the core and winding to be lifted.

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

10.10 The supporting frame work of the cores shall be so designed as to avoid the presence of pockets which would prevent complete emptying of the tank through the drain valve or cause trapping of air during filling.

10.11 The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000 VAC at 50HZ for one minute.

11.00 FLUX DENSITY OF CORE:

11.01 The maximum flux density in any part of the core and yokes at principal (normal) tapping and at rated frequency shall not exceed 1.69 Tesla (16900 lines per sq.cm) at normal voltage and 1.9 Tesla (19000 lines per sq.cm) under overvoltage condition.

Prior to inspection and testing of the Transformer the supplier shall submit on request following curves of the core manufacturer.

i) Flux density vs. Core loss.
ii) Flux density vs. Excitation

12.00 WINDING:

12.01 All windings shall be fully insulated and foil winding will not be acceptable.

12.02 Power transformer shall be designed to withstand the impulse and power frequency test voltages specified in clause no. 9.01.

12.03 The windings shall be designed to reduce to a minimum the out of balance forces in the transformer at all voltage ratios.

12.04 The insulation of Transformer winding and connections shall be free from insulating material liable to soften, ooze out shrink or collapse and shall be non-catalytic and chemically inactive to transformer oil during service.

12.05 The stacks of windings shall receive adequate shrinkage treatment before final assembly. Adjustable device shall be provided for taking up any possible shrinkage of coils in service.

12.06 All the insulating materials to be used in the transformer shall preferably be of class-A insulation as specified in Indian Standards. The test certificate of the raw materials shall be made available by the Transformer manufacturer on request during inspection and testing.

12.07 The coil clamping arrangement and the finished dimensions of any oil ducts shall be such that it will not impede the free circulation of oil through the ducts.

12.08 The windings and connection of transformer shall be braced to withstand shocks which may occur during transport or due to switching short circuit and other transient conditions during service. In any case crimping at joints is notallowed.

12.09 Coil clamping rings, if provided shall be of steel or suitable insulating material. Axially laminated material other than backelised paper shall not be used.

13.00 INTERNAL EARTHING ARRANGEMENTS:

13.01 General: All metal parts of the transformer with the exception of the individual core laminations, core bolts and associated individual clamping plates shall be maintained at fixed potential.

13.02 Earthing of core clamping structure: Core clamping structure shall be earthed in terms of clause no. 10.06.

13.03 Earthing of coil clamping rings: Where coil clamping rings are of metal at earth potential, each ring shall be connected to the adjacent core clamping structure on the same side of transformer as the main earth connection.

14.00 TANKS:

14.01 Construction: Conventional type tank having plain surface shall be constructed. The Transformer tank and cover shall be fabricated from good commercial grade low Carbon steel suitable for welding and of adequate thickness. The tanks of all transformers shall be complete with all accessories and shall be designed so as to allow the complete transformer in the tank and filled with oil, to be lifted by crane or jacks, transported by rail, road without overstraining any joint and without causing subsequent leakage of oil. The main tank body shall be capable of withstanding vacuum gauge pressure 68.0 KN per Sq, metres (500 mm. of HG). The under carriage of the tank shall be made of channel of suitable size and design.

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 plate or rails. Where the base is of a channel construction, it shall be designed to prevent retention of water.

Tank stiffeners shall be designed to prevent retention of water.

Wherever possible the Transformer tank and its accessories shall be designed without pockets wherein gas may accumulate. Where pockets cannot be avoided, pipes shall be provided to vent the gas into the main expansion pipe.

All joints other than those which may have to be broken shall be welded when required they shall be double welded. All bolted joints to the tank shall be fitted with suitable oil tight gaskets which shall give satisfactory service under the operating conditions and guaranteed temperature rise conditions. Special attention shall be given to the methods of making hot oil tight joints between the tank andthe cover as also between the cover and bushing and all other outlets to ensure that the joints can be remade at site satisfactorily.

Ladder with anti climbing safety locking arrangement should be provided at a suitable location so as to provide a suitable means for climbing to the tank top cover.

14.02 **TANK COVER:**

Each tank cover shall be of adequate strength and shall not distort when lifted. Inspection cover placed on turret shall be provided as necessary to give easy access to bushings or changing ratio or testing the earth connection. Each inspection cover shall be of adequate size for the purpose for which it is provided and should be provided with Air release plug.

The tank cover and inspection cover shall be provided with suitable lifting arrangement. The tank cover shall be fitted with pockets for thermometer and for the bulbs of Oil and Winding temperature indicators. The thermometer pocket shall be fitted with a captive screwed top to prevent the ingress of water. Protection shall be provided, where necessary, for each capillary tube. The pocket shall be located in the position of maximum oil temperature and it shall be possible to remove the instrument bulbs without lowering the oil in the tank. Turrets should be provided on tank cover to house the bushings. The top of turrets of both HV & LV bushings should be connected through pipes with main tank Buchholz Relay pipe to drive out trapped air. Turret top of LV side should have bolted cover on which C.T. is provided and turret pipe should have suitable sections so that top covers of the bolted bushing turrets can be removed in order to have access to the CTs as and when required, inside them and the bushing CTs should

be so positioned that it can be attended/replaced by removing the top cover of bushing turret and box cover for WTI CT secondary terminals and secondary terminals of other C.Ts.

Neoprene rubber gaskets of adequate thickness are to be provided at all junctions of Transformer main tanks and fittings from where there is a possibility of oil leakage and the oil leakage. The gasket should be continuous without any open end as far as practicable and if it is not possible to provide, the junction point should be made of proper dovetail arrangement.

15.00 CONSERVATOR VESSELS:

15.01 **Conservator vessels:** The conservator should be air cell/atmoseal type to prevent direct contact of Transformer oil with atmospheric air for retarding oxidation contamination of oil. The Air cell shall be made from suitable material with outer coating resistant to transformer oil & inner coating resistant to ozone & weathering.

The conservator shall be provided with necessary valves to drive out the air in the space between conservator wall & air cell during filling of oil, drain valves for complete draining of oil and cut off valves etc.

The conservator complete with necessary valves shall be provided in such a position as not to obstruct the electrical connections to the transformer from H.V & L.V Side.

The conservator shall be of capacity to meet the requirement of expansion of the total cold oil volume in the Transformer & cooling equipment and it should be such that the oil level will always be visible through the plain oil level gauge.

The conservator shall be designed so that it can drain oil completely by means of the drain valve provided when mounted. One end of the conservator shall be bolted into position so that it can be removed for cleaning purpose.
The conservator shall be provided with different valves as per enclosed Figure-1 for filling of oil manually at site.

15.02 **OIL GAUGES**: One Magnetic type oil gauge shall be provided. The oil level at 30 Deg. C. shall be marked on the gauge along with 1/4th Level, max & Min. level. A plain oil level gauge of prismatic type is also to be provided on the opposite side of the conservator, on which MOG is provided with marking as per ISS.

15.03 **CONNECTION**: The oil connection from the transformer tank to the conservator vessel shall be arranged at a raising angle of 4 to 9 degrees to the horizontal up to the Buchholtz Relay and shall consist of pipe with inside diameter 50 mm./80 mm. as per capacity of the Transformer and as per IS:3639. Two valves shall be provided between the conservator & Transformer main tank to cut off the oil supply to the transformer after providing a straight run of pipe for at least a length of five times the internal diameter of the pipe on the tank side of the Gas and Oil actuated Relay and at least three times the internal diameter of the pipe on the conservator side of the Gas and Oil actuated Relay. The valves should be fitted on both side of the Gas and Oil Actuated Relay.

15.04 **Breather:**
Each conservator vessel shall be fitted with a glass container type breather in which silica gel is dehydrating agent and so designed that

i) The passage of air through the Silica gel.

ii) The moisture absorption indicated by a change in colour of the tinted

crystals can be easily observed from the distance.

iii) All breathers shall be mounted at approximately 1400 mm above ground level and shall be connected to the air cell of the conservator through pipe for the purpose of breathing during contraction or expansion of the air cell.

iv) 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. The same arrangement shall be made fin case of breather associated with OLTC tank conservator.

16.00 Insulator suitable for heavily polluted atmosphere should be used. The bushing should be located on suitable turrets. Adjustable Arcing horns should be provided on the Bushings. Bushings of Identical voltage rating shall be inter-changeable. All bushings shall be equipped with suitable terminals of approved type size and shall be suitable for bimetallic connection.

The bushing shall have high factor of safety against leakage to ground and so located as to provided adequate electrical clearance between bushings & grounded parts. Both HV & LV Bushing should be suitable for use in heavily polluted atmosphere as per IS 8603 (Part I & III) 3 Nos. H.V Bushings & 4Nos. L.V. Bushing should be supplied extra with the transformer as spare.

17.00 FILTER AND DRAIN VALVES, SAMPLING DEVCES AND AIR RELEASE PLUGS:

17.01 Each Transformer shall be fitted with the following:

i) The filter and drain valves as specified.

ii) A drain valve as specified below shall be fitted to each conservator.
For diameter up to 650 mm: Size of the valve 15 mm: for diameter above 650 mm : Size of the valve 25 mm.

iii) Suitable oil sampling device shall be provided at the top and bottom of the main tank. The sampling device shall not be fitted on the filter valves specified under (2) above.

iv) One 15mm air release plug on the inspection cover as placed on the main tank top cover of the Transformer.

v) All other valves opening to atmosphere shall be fitted with blank flanges.

vi) The drain valve and bottom filter valve should be provided with a protective cover with nuts and bolts arrangement.

18.00 COOLING ARRANGEMENT

18.01 General: Radiators shall be so designed as to avoid pockets in which moisture may collect and shall withstand the pressure tests.

The radiator tubes/fins shall be seamless, made of mild steel having as minimum wall thickness of approx. 1.2mm and a clean bright internal surface free from dust and scale. They shall be suitably braced to protect them from mechanical shocks, normally met in transportation and to damp the modes of vibration transmitted by the active part of the transformer in service. Each cooler unit shall have a lifting eye.

18.02 Radiator Valves: The butterfly or similar metal valves shall be provided for isolating detachable radiator assembly.

One cock each at the bottom of radiator stack shall be provided for draining oil from radiator stacks.

Air release plug each at the top of radiator stack shall be provided for release of locked air from radiator stack.

Removable blanking plates shall be provided to permit the blanking off the main oil Connection of each cooler.

18.03 Radiator fixing bands in top & bottom of radiators to be provided to minimise the vibration of the same.

19.00 LIFTING AND HAULAGE FACILITIES:

19.01 Each tank shall be provided with

(i) Lifting lugs suitable for lifting of transformer complete with oil.

(ii) A minimum of foul jacking lugs, in accessible positions to enable the transformer complete with oil to be raised or lowered using hydraulic or screw jacks. The minimum height of the lugs above the base shall

(a) Transformers up to and including 10 tones weight-300mm

(b)Transformers above 10 tones weight – 500 mm.

(iii) Suitable haulage holes shall be provided.

19.02 INSULATING OIL:

19.03 The Transformer and all associated oil filled Equipment shall be supplied complete with insulating new oil required for first filling including 10% extra oil for future use during commissioning. The Transformer tank shall be dispatched completely filled with oil and the balance oil shall be supplied in non returnable sealed drums along with the Transformers.

The Insulating oil in sealed barrel shall conform to the requirement of IS 335: 2018 with latest amendment. Manufacturers have to arrange testing of BDV and moisture content for oil sample taken from main tank and OLTC during Power Transformer Routine Test and acceptance testing at Manufacturer's Premises as per IS 1866:2000 with latest amendment in presence of WBSEDCL Inspectors. In case of unavailability of test setup as required, Manufacturers have to arrange testing of Transformer Oil from WBSEDCL Lab or CPRI with cost basis before dispatch of material.

Manufacturers have to arrange BDV, moisture content, acidity, Tan-Delta, resistivity and other required parameters as per IS 1866:2000 with latest amendments before commissioning after oil-filled in New Power Transformer and OLTC.

20.00 PRESSURE RELIEF DEVICE:

20.01 Pressure relief device (Operating pressure – 0.49 Kg/cm^2) shall be provided of sufficient sizes for repaid release of any pressure that may by generated within the tank, and which might result in damage to the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure for transformer tank. Means shall be provided to prevent ingress of rain. It shall be mounted on the cover of the main tank and shall be designed to preventgas accumulation.

Spring loaded setting type Pressure Relief Valve having suitable opening Port hole according to the capacity of the transformers should be provided. The pressure relief valve should have provision of visual indication for opening of the valve and also Contract/Micro Switch arrangement for alarm/Tripping Function.

21.00 AXIS AND WHEELS:

21.01 The Transformer shall be provided with flanged bi-directional wheels as mentioned below:

21.02

Transformer rating in MVA	Type
6.3	Flanged wheel suitable for use on a 1435 mm gauge track.
10	Flanged wheel suitable for use on a 1435 mm gauge track.

The wheels shall be suitable for being turned through an angle of 90 Deg. And locked in that position when the tank is jacked up.

All wheel shall be detachable and shall be made of Cast Iron or Steel.

Suitable locking arrangement shall be provided to prevent the accidental movement of the transformer.

22.00 CLEANING & PAINTING

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

The interior of all transformer tanks and other oil filled chambers and internal structural steel work shall be thoroughly cleaned of all scale and rust by sand blasting or other approved method. These surfaces shall be painted with hot oil resisting varnish or paint. Unexposed welds need not be painted.

Except for nuts, bolts and washers, which may have to be removed for maintenance purposes, all external surfaces shall receive a minimum of three coats of paint.

The primary coat shall be applied immediately after cleaning. The second coat shall be of oil paint of weather resisting nature and preferably of a shade or colour easily distinguishable from the primary and final coasts shall be applied after the primary coats have been touched up where necessary. The final coat shall be of glossy oil and weather resisting non fading paint of Dark Admiralty Grey shade no. 632 of IS:5. Primer paint shall be ready made zinc chrome as per IS: 104: Intermediate and final costs of paint shall be as per IS: 2932.

All interior surfaces of mechanism chambers and kiosks except those which have received anti-corrosion treatment shall receive three coats of paint applied to the thoroughly cleaned metal surface as per procedure mentioned above. The final coat shall be of a light coloured anti-condensation mixture.

Any damage to paint work incurred during delivery shall be made good by the manufacturer by thoroughly cleaning the damage portion and applying the full number of coats of paint that had been applied before the damage was caused.

23.00 EARTHING TERMINAL

23.01 Two earthing terminals capable of carrying the full amount of lower voltage short circuit current of transformer continuously for a period of 5 Second Provision shall be made at positions close to each of the bottom two corners of the tank for bolting the earthing terminals to the tank structure to suit local condition.

24.00 TEMPERATURE INDICATING DEVICES :

24.01 Oil temperature indicator with two electrical contacts for alarm and trip purposes and with repeater for remote indication, shall be provided with anti vibration mounting. The oil temperature indicator shall be housed in the marshallingbox.

24.02 The winding temperature indicator with two electrical contacts for alarm & trip purposes and with repeater for remote indication shall be provided with anti vibration mounting. The winding temperature indicator shall be housed in the marshalling Box.

The Oil and Winding temperature indicator should be of renowned make preferably of "Perfect Control" or "Precimeasure" or "Aditya Mechatronics". The scale on the dial of the thermometer should be 0^0C to 150^0C.

The angular displacement of thermometer should be 270 Deg. The signaling contact of WTI & OTI shall be set to operate at the following temperature:

OIL : Alarm-80 deg. C, Trip – 90 deg. C
WINDING : Alarm-85 deg. C, Trip – 95 deg.C

24.03 The tripping contacts of indicator shall be adjustable to close the winding temperature indicator between 60 Deg.C and 120 Deg.C. The alarm contacts of indicator shall be adjustable to close between 50 Deg.C & 100 Deg.C.
All contacts shall be adjustable on a scale and shall be accessible on removal of the cover. The Temperature indicators shall be so designed that it shall be possible to check the operation of contacts and associated Equipments.
For measuring winding temperature a heater coil fed from a C.T. has to be provided on the pocket for winding temperature indicator bulb. The connection from C.T. to heater should be through a link arrangement on the tank cover suitably housed in a weather proof box so that
C.T. current and heater coil resistance can be checked. WTI C.T. secondary should be of 5 Amps, rating and the resistance value should be of value ≤ 25 watts. The winding C.T ratio for 6.30MVA shall be 330/5A and for 10.00 MVA it shall be 525/5A. The WTI C.T. should be placed at L.V. side b-phase lead beneath the L.V. side b-phase bushing turret cover in order to provide means for easy access for maintenance.
OTI & WTI tested from Distribution Testing Department of WBSEDCL should be supplied along with each transformer.

25.00 MARSHALLING BOX

25.01: A sheet steel vermin proof, well ventilated and weather proof marshalling box of a suitable construction shall be provided for the transformer ancillary apparatus. The box shall have domed or sloping roofs and the interior & exterior painting shall be in accordance with clause no.22

The marshalling box shall accommodate:-

i) Winding and oil temperature indicator.
ii) Disconnecting type Terminal Blocks for bushing CT & other Terminal blocks as required and gland plates for incoming and outgoing Cables with at least additional 4 no. of holes of 20mm size fitted with grommet to be provided.
iii) One space heater operated by 220 V.A.C. Aux. Supply, Cubicle illuminating lamp with door switch.

iv) Oil filling instruction plate at man height from ground level and at conservator body facing transformer as perAnnexure-A

v) The approved wiring diagram of Marshalling box should be provided in a metal plate mentioning the terminal nos. and the control cable or C.T secondary terminals for which those terminals are meant for.

vi) For easy access, there should be minimum gap of 150mm from the lower TB to the gland plate.

All the above equipment shall be mounted on panels and back of panel wiring shall be used for Interconnection. The temperature indicators shall be so mounted that the dials are visible by standing at ground level.
Door of the compartment shall be provided with non glass transparent type acrylic window of adequate size.
Ventilation louvers shall be provided.
Suitable removable cable glands plate shall be provided at the bottom of kiosk for passage of Incoming and outgoing cable.

26.00 GAS AND OIL ACTUATED RELAYS

Each transformer shall be provided with gas and oil actuated Relay (Buchholtz Relay) equipment conforming of IS:3637 double float type with one set of alarm contacts, one set of trip contacts and a testing pet cock. The contacts shall be wired with a P.V.C. armoured cable.

A machined surface shall be provided on the top of Relay to facilitate the setting of Relay and to check the mounting angle in the pipe and cross level of the Relay.

The pipe work shall be so arranged that all gas arising from the Transformer shall pass into the gas and oil actuated Relay. The oil circuit through the Relay shall not form a delivery path in parallel with any circulating oil pipe. The Buchholz relay should have gas collection pit cock with extension pipe with proper fixingarrangement.

27.00 RATING DIAGRAM AND PROPERTY PLATES :

27.01 The following plates shall be fixed to the transformer tank at a suitable height so that the particulars could be read by standing at ground level.

i) A rating plate bearing the date specified in the relevant clauses of IS: 2026 including figures of temperature rise of oil and winding and high voltage test values.

ii) A diagram plate showing the internal numbering of taps, tapping switch connection of windings and also the voltages vector relationship in accordance with IS:2026 and in addition a plan view of the transformer giving the correct physical relationship of the terminals. No load voltage shall be indicated for each tap. Details of C.T particulars i.r.o phase, Neutral & WTI CT.

iii) A property plate showing that the equipment belongs to West Bengal State Electricity WBSEDCL with reference of purchase order.

28.00 CENTRE OF GRAVITY:

28.01: The centre of gravity of the assembled transformer shall be low and as near the vertical centre line as possible. The transformer shall be stable with or without oil. If the centre of gravity is eccentric relative to track either with or without oil, its location shall be shown on the outline drawing.

29.00 OPERATION:

29.01 The transformer shall be suitable for operating in WBSEDCL's Sub-Stn. Independently.

or in parallel with one or more transformers.

30.00 DUTY UNDER FAULT CONDITION:

30.01: It is to be assumed that normal 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.

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.

The thermal ability to withstand short circuit shall be Two seconds (2 Sec.) without injury for 3 phase dead short circuit at the terminals.

31.00 RATED VOLTAGE OF OPERATING DEVICE:

31.01: Rated voltage for indicating & operative device shall be 30 volts D.C./110 volts D.C./240 Volts D.C./230 volts A.C. with variation as specified in the relevant I.S.

32.00 FITTINGS:

32.01: Fittings as listed in schedule 'A' shall be provided.

33.00 FOUNDATION:

33.01: The tenderer shall furnish foundation plan of the transformer showing the fixing arrangement of the transformer so that the purchase may be able to finalise the foundation drawings.

34.00 TEST AND INSPECTION:

34.01: Routine Tests :

All transformers shall be subjected to the following routine tests at the manufacturer's works. The tests shall be carried out in accordance with the details specified in IS: 2026.

i) Measurement of winding resistance.

ii) Measurement of turns ratio for all sets windings on each tap

iii) Polarity and phase vector relationship.

iv) Measurement of no load loss and no load current

v) Measurement of impedance voltage at normal , maximum and minimum tap

vi) Measurement of insulation resistance between windings and between windings and earth.

vii) Measurement of load loss at principal Tap & at Lowest Tap position.

viii) Induced over voltage withstand test.

ix) Separate source voltage withstand test.

x) Oil Leakage gas collection, oil surge and voltage test on gas and oil actuated relay for on load tap changer.

xi) Magnetic balance test.

xii) Testing of Phase & Neutral C.T., as applicable, in accordance with provisions in the relevant I.S.

xiii) Oil leakage test of transformer tanks at a pressure equals to the normal pressure plus 35 KN/ sq.M measured at the base of tank.

xiv) Insulating OIL BDV and Water Content measurement.

34.02 **Type Test** :

In addition to routine Tests mentioned above the transformer shall be subjected to all kinds of Type and Acceptance Test in accordance with Relevant I.S. (IS: 2026) with latest amendment if any.

1) Bidder should submit Type Test report from CPRI/NABL/Govt. Approved Laboratories along with their offer having identical or higher 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.

2) However, after placement of order, Type tests after successful routine & temperature rise test shall have to be done on each type of transformer designed as per specification of WBSEDCL and approved drawing. Such Type tests/special tests are to be carried out at CPRI/ NABL/Govt. approved Laboratories in presence of WBSEDCL engineers at your cost.

3) Routine & Temperature rise Test have to be carried out in presence of WBSEDCL engineers before carrying out type test.

4) Temperature rise Test shall have to be conducted on one no Transformer of each type against the order.

34.03: INSPECTION AND TESTING :

Inspection and testing as already mentioned the equipment shall be subjected to routine and other acceptance tests as per provisions in the relevant I.S.

The 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 the requirement of the specification and also shall have the right to select any/all equipment from the lot offered for tests.

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

The Supplier shall arrange all possible facilities for such inspection and testing at any time during the course of manufacture free of cost.

34.04: TEST CERTIFICATE:

Seven copies of the approved Test Certificates as mentioned above are to be furnished to the WBSEDCL before dispatch of the equipment.

35.00 35.01 The following drawings and details shall be furnished in triplicate along with the tender:

i) General Arrangement outline drawing with plan, elevation and end views showing various dimensions of transformer and its vital component including height of the

bottom most portion of bushing from the bottom of base channel and also indicating thereon physical centre line and position of centre of gravity.

ii) Three copies of sketches for height of crane hook above ground for lifting and un-tanking core, shipping dimensions, complete lists of fittings and devices, net weights of core, winding, tank, radiator, oil, conservator and total weight, fixing arrangement of transformer in foundation.

iii) Marshalling Box drawing.

iv) Installation, operation and maintenance manual.

35.02: The following drawings and manuals in six sets shall be submitted for approval within 15 (fifteen) days from date of placement of L.O.I./ORDER.

v) As stated in clause no. 36.01.

vi) Cross sectional details with plan, elevation, and views showing all internal clearances.

vii) Drawing of Name & rating plate.

viii) Drawing of Diagram & property plate.

ix) Drawing of Instruction plate for oil filling at site as per Annexure –A

x) Drawing of OLTC &RTCC with features of SCADA operation as per ANNEXURE-B

xi) Installation, operation and maintenance manual of transformer, associated equipment like buchholz Relay, temperature indicators, oil level indicator etc.

The manual shall clearly indicate the installation method, check-ups and tests to be carried out before and after commissioning of the transformer.

One copy of manual, set of approved drawings shall be submitted to the Chief Engineer (Testing), Distribution Testing Laboratory, Abhikshan Bldg., Salt Lake, Kolkata-91 before dispatch of the Transformer.

In addition one set of approved drawing, manual for transformer shall be send to the respective consignee officer in water proof folder at the time of delivery of the transformer.

36.00 GUARANTEED TECHNICAL PARTICULARS :

36.01: Bidder shall furnish guaranteed technical particulars of equipment offered as per Schedule 'B', Performance Guarantee shall be based on guaranteed technical particulars.

37.00 SHORT CIRCUIT CALCULAOTIONS:

Manufacturer shall submit theoretical calculations in support of the ability to withstand short circuit on consideration of highest value that may attain in triplicate within 15 (fifteen) days from the date of placement of L.O.I./Order.

38.00 PERFORMANCE CERTIFICATES:

38.01: Copies of performance certificates of similar Equipment supplied to various organizations shall have to be furnished along with Tender.

39.00 CREDENTIALS:

39.01: Tenderer shall furnish documents in support of Supply, Delivery of similar Equipment indicating thereon names of the organization, quantity ordered, quantity supplied along with tender.

40.00 DEVIATION:

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, itwill be taken for granted that the offer is made in conformity with Specification.

41.00 SPARE PARTS:

The Tenderer shall submit a recommended list of spare parts for five years of operation along with item wise price for each item of spares.

42.00 TESTING INSTRUMENTS:

The bidder should have the following instruments

1) KV Meter in the range 0-30KV &0-100KV
2) Milli Ampere meter for leakage current
3) Volt Meter in the range 0-1000V
4) Frequency Meter in the range 0-100Hz or 0-200 Hz as the case may be.
5) Power Analyser of reputed make and capable of correct measurement of current, voltage, wattage of all the 3 phases in 3Ø-4wire measurement system & frequency.
6) Transformer Turns ratio meter
7) Winding Resistance Measuring bridge of make M/S ELTEL or equivalent of reputed make.
8) Digital Multimeter.
9) Clamp On Ammeter(0-300A)
10) 5 KV Motorised Megger for Insulation resistance & PI measurement.
11) CT analyser for measurement of VK & RCT.
12) Instrument for insulating OIL BDV and water content measurement.

SCHEDULE – A

	FITTINGS & ACCESSORIES :
A.	All screw threads and nuts shall be made as per ISS and all valves shall be of standard tested quality and leak-proof.
B.	The following fittings and accessories shall be supplied with each Transformer :
1.	Outdoor type bushing – HV-3 Nos. and LV-4 Nos. suitable for heavily polluted atmosphere.
2.	Conservator with atmoseal and supporting bracket or structure as the case may be.
3.	Isolating valve for conservator in between conservator and Buchholtz Relay and in between Buchholtz relay and main tank.
4.	Conservator valves for driven out air between air cell & wall of conservator & connection to breather.
5.	Conservator drain valve.
6.	Dial type oil level indicator complete with alarm contact.
7.	Silica gel breather with oil seal and connecting pipe. The breather shall be accessible for inspection from ground. Another Silica gel breather with oil seal shall also be provided in the conservator for OLTC tank.

8.	Spring loaded setting type pressure relief Valve having suitable opening Port. Hole & provision of visual indication for opening of the valve & Alarm/Trip contact arrangement both in the main & OLTC tank
9.	Access/inspection holes with bolted cover for access to inner ends of bushing.
10.	Cover lifting eyes.
11.	Lifting eyes for core frame with windings.
12.	Tap changing arrangement with OLTC Driving mechanism Box and with matching RTCC Panel.
13.	Air release plugs on top of inspection cover of main tank top cover and a pipe shall be provided connecting the top of bushing turrets to the Buchholz relay so that any trapped air in those parts may be accumulated in the Buchholz relay. The connecting pipe shall have suitable sections so that the bolted turret covers can be opened to attend the C.T. provided therein.
14.	Upper filter valve and bottom filter valve.
15.	Drain valve.
16.	Top and bottom oil sampling devices. Provision for oil sample collection during process of filtration should be made.
17.	Lifting lugs.
18.	Jacking pads with handling holes at four corners.
19.	Transport lugs & Ladder with anti climbing locking arrangement.
20.	Under carriage base channel.
21.	Tank earthing terminals – 2 Nos.
22.	Bachholz relay double float type with one set of alarm contacts, one set of trip contacts and testing pet cock. The contacts should be wired with a PVC armoured cable.
23.	Dial thermometer for winding temperature with alarm contacts and Trip contacts & repeater for remote indication
24.	Dial thermometer for oil temperature with alarm contacts and Trip Contacts & repeater for remote indication.
25.	An additional pocket for inserting thermometer for oil temperature indication.
26.	Weather proof control cabinet for marshalling terminal connections from protective and indicative devices. The cabinet shall be provided with incandescent filament lighting, plugs etc.
27.	Neutral Bushing C.T. suitable for installation in L.V. side of Power Transformer for 6.3 MVA and Bushing C.T. suitable for installation in L.V. side in r,y,b phases and also neutral C.T. of 10 MVA Power Transformer.
28.	Rating plate, as per I.S.S.
29.	Diagram Plate : As per clause 28.
30.	Property label.
31.	Oil filling instruction plate shall be provided at i) conservator body, ii) tank body along with rating and diagram plate.
32	Oil Surge Relay for OLTC tank and to be placed in between OLTC tank and OLTC Conservator

SCHEDULE – B

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS:

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

Sl. No.	Particulars		
1.	Name and address of the manufacturer	:	
2.	Country of origin	:	
3.	Applicable standard	:	
4.	Maximum continuous rating (in MVA)	:	
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.	Tappings	:	
	(a) Range	:	
	(b) Number of steps	:	
	© Variation of voltage in each step (in KV)	:	
	(d) No load voltage ratio in each tap (in KV/KV)	:	

Tap Number	Voltage ratio in KV/KV		Tap Number	Voltage ratio in KV/KV
1.			10.	
2.			11.	
3.			12.	
4.			13.	
5.			14.	
6.			15.	

	7.			16.	
	8.			17.	
	9.				

12.	(i) Temperature rise under normal operating condition above ambient temperature		:	
	(a) Top oil (in Degree C)		:	
	(b) Windings (in Degree C)		:	
	(ii) Maximum hot spot temperature of Copper windings (in Degree C)		:	
13.	Magnetising 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.	Max^{m} No load loss in KW at rated frequency and voltage		:	
	(a) at Lowest tap		:	
	(b) at principal tap		:	
	(c) at highest tap		:	
17.	Max^{m} 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.	Percentage Regulation at full load at 75^{o}C		:	
	(a) at unity power factor		:	
	(b) at 0.8 power factor lagging		:	
19.	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	:	
20.	Impedance voltage on rated MVA base at rated current and frequency for the Principal tapping 75 Deg.C. (in percentage)		:	
21.	a) Reactance voltage at rated current and frequency for the principal tapping at 75°C (in percentage)		:	
	b) Resistance voltage at rated current and frequency for the principal tapping at 75°C (in percentage)		:	
22.	Resistance at H.V. base at 75 Deg.C.		:	
	(a) at Lowest tap		:	
	(b) at principal tap		:	
	(c) at highest tap		:	
23.	Reactance at H.V. base at 75 Deg.C.		:	
	(a) at Lowest tap		:	
	(b) at principal tap		:	
	(c) at highest tap		:	
24.	Withstand time without injury for three phase dead short circuit at terminal (in seconds)		:	
25.	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)		:	
26.	Permissible overloading with time		:	
27.	Core :		:	
	i) Type		:	
	ii) Flux density of Core and yoke at principal tap		:	
	a) at 100% rated voltage at 50 Hz (in lines/sq.cm		:	
	b) at 110% 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	:			
28.	Terminal Arrangement	:			
	i) High Voltage	:			
	ii) Low Voltage	:			
29.	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)	:			
30	Zero Sequence Impedance at reference temperature of 75 Deg.C at principal tap (in percent)	:			
31.	Details of windings	:			
	i) Type of Winding	:			
	(a) High Voltage	:			
	(b) Low Voltage	:			
32.	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 MVA	:	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 provided 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	:			
	viii)Type of Radial Coil Supports	:			
	(a) H.V. winding	:			
	(b) L.V. winding	:			
	ix) Current in the winding at rated MVA	:	At principal tapping	At lowest tapping	At highest tapping
	(i) Low voltage (in Amps)	:			
	(ii) High voltage (in Amps)	:			
33	Insulation withstand Test voltages	:	H.V.	L.V.	
	i) Lightning Impulse withstand test voltage (KV Peak)	:			
	(ii) Power frequency withstand test voltage (in KV rms for 1 min)	:			
	(iii) Induced over voltage withstand test voltage (in KV rms)	:			
34	Voltage per turn (KV per turn)	:			
35	Ampere turn	:			
36.	Number of turns	:	At principal tapping	At lowest tapping	At highest tapping
	(i) Low Voltage	:			
	(ii) High Voltage	:			
37.	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	:		
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 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	:		
39.	Minimum clearance (in mm)	:		
		:	In Oil	In Air
		:	Between Phases / Phase to Ground	Between Phases / Phase to Ground
	i) H.V.	:		
	ii) L.V.	:		
40.	Particulars of Bushing & Neutral C.T.	:		
	i) Type	:		
	ii) Ratio	:		
	iii) Accuracy Class	:		
	iv) Knee Point Voltage	:		
	v) RCT at 75 Deg.C			
	vi) Magnetising Current at Knee Point Voltage	:		
	vii) Additional winding particulars of testing on the C.T.	:	:	
	viii) Short Time Rating	:		
	ix) Reference Standard	:		
41	Approximate weight of Transformer (in Kgs)	:		
	i) Core with clamping	:		
	ii) Coil with insulation	:		

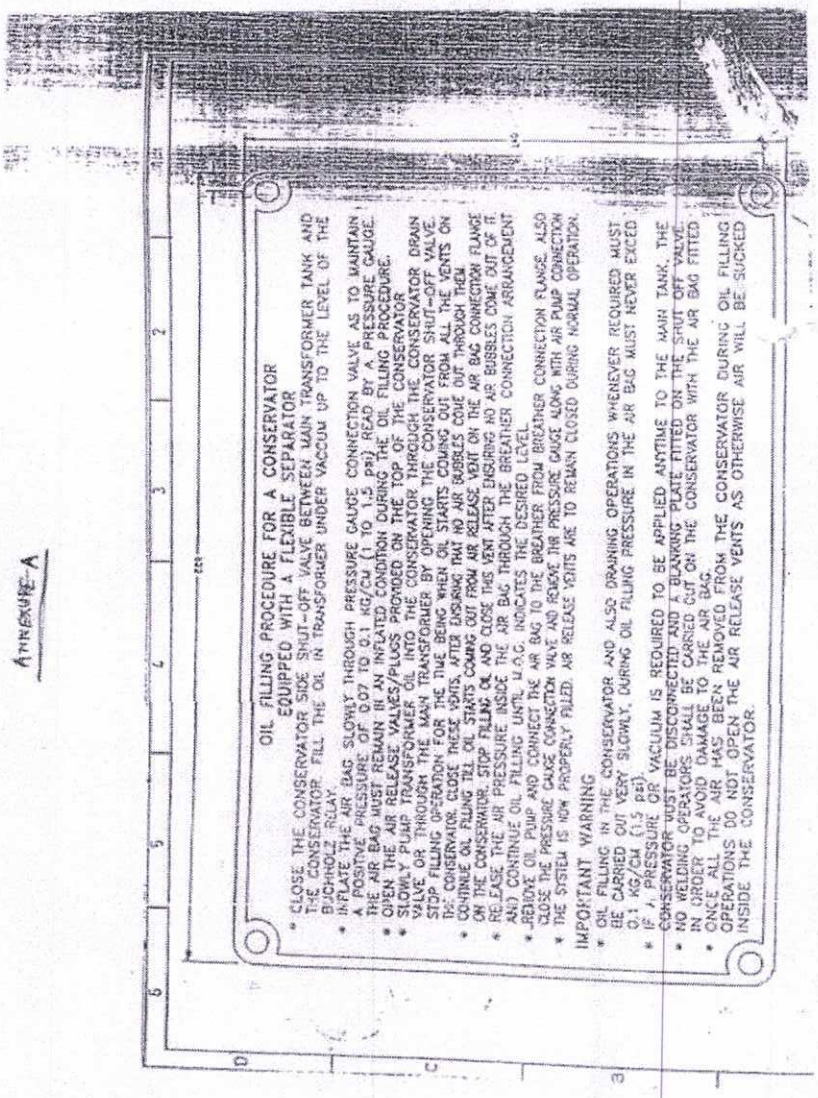
	iii) Core and winding	:	
42.	Tank and fitting with accessories	:	
	i) Untanking weight	:	
	ii) Oil required for first filling	:	
	iii) Total weight with Core, Winding, Oil Fittings	:	
43.	Details of Tank		
i)	Type of tank	:	
ii)	Approximate thickness of Sheet (in mm)	:	
	a) Sides	:	
	b) Bottom	:	
	c) Cover	:	
	d) Radiators	:	
iii)	Vacuum recommended for hot oil circulation (in torr.)	:	
iv)	Vacuum to which the tank can be subjected without distorsion (in torr.)	:	
v)	Under carriage dimensions	:	
	a)No. of bidirectional wheels provided	:	
	b) Track gauge required for the wheels	:	Axis: Transverse | Longitudinal
vi)	Dimension of base channel (in mm x mm)	:	
viii)	Type of Pressure relief device / Explosion Vent and pressure at which it operates	:	
44.	Conservator	:	
	i) Total volume (in Litres)	:	
	ii) Volume between the highest and Lowest visible oil level (in litres)	:	
45.	Oil Quality (both Main Tank and OLTC)	:	
	i) Applicable standard a. Before Tanking: As per IS 335:2018	:	YES
	b. After Tanking : As per IS 1866:2000 with latest amendment. Samples taken from Main tank and OLTC Tank		Yes BDV:40KV(Min) Water Content:20PPM(max)
	ii) Total quantity of oil (in Litres)	:	
46.	Radiator	:	

	ii) Number of tubes/fins in each radiator Bank	:		
	iii) Thickness of tubes/fins (in mm)	:		
	iv) Overall dimensions (in mm)	:		
	a) Length b) Breadth c) Height	: : :		
	v) Type of mounting	:		
	i) Vacuum withstand capability	:		
47	Gas And Oil Actuated Relay	:		
	i) Make	:		
	ii) Type	:		
	iii) Number of float contacts	:		
48	Temperature Indicators	:	Oil Temperature Indicator	Winding Temperature Indicator
i)	Make	:		
ii)	Type	:		
iii)	Permissible setting ranges for alarm and trip	:		
iv)	Number of contacts	:		
v)	Current rating of each contact	:		
49.	Approximate overall Dimensions (in mm)	:		
	a) Length	:		
	b) Breadth	:		
	c) Height	:		
	d) Minimum height of bottom most protion of bushing from bottom of base channel	:		
50.	Minimum clearance height for lifting tank cover (in mm)	:		
51.	Make of OLTC	:		
52.	Whether OLTC is Type tested	:		
53.	whether OLTC is in line with the specification	:		
54.	Make of RTCC	:		
55.	whether RTCC is in line with the specification	:		
56.	Whether Type & Special Tests reports in line with the	:		

	specification has been submitted?		
57.	Whether the transformer on which Type & Special Tests have been conducted is identical in design with the offered Transformer?	:	
58.	Whether the Type & Special Tests reports are conducted within 5 Years?	:	
59.	Whether agreeable to carry out Type Tests & Special Tests free of cost, if it is found that the transformer on which Type & special Tests are conducted is not identical in design with the offered transformer:	:	
60.	Whether all the testing facility as per specification are available at works?	:	
61.	Whether all particulars as specified above are furnished?	:	

SIGNATURE OF THETENDERER
WITH COMPANY'S SEAL

ANNEXURE-A


OIL FILLING PROCEDURE FOR A CONSERVATOR
EQUIPPED WITH A FLEXIBLE SEPARATOR
* CLOSE THE CONSERVATOR SIDE SHUT-OFF VALVE BETWEEN MAIN TRANSFORMER TANK AND THE CONSERVATOR. FILL THE OIL IN TRANSFORMER UNDER VACCUM UP TO THE LEVEL OF THE BUCHHOLZ RELAY
* INFLATE THE AIR BAG SLOWLY THROUGH PRESSURE GAUGE CONNECTION VALVE AS TO MAINTAIN A POSITIVE PRESSURE OF 0.07 TO 0.1 KG/CM (1 TO 1.5 PSI) READ BY A PRESSURE GAUGE. THE AIR BAG MUST REMAIN IN AN INFLATED CONDITION DURING THE OIL FILLING PROCEDURE.
* OPEN THE AIR RELEASE VALVES/PLUGS PROVIDED ON THE TOP OF THE CONSERVATOR
* SLOWLY PUMP TRANSFORMER OIL INTO THE CONSERVATOR THROUGH THE CONSERVATOR DRAIN VALVE OR THROUGH THE MAIN TRANSFORMER BY OPENING THE CONSERVATOR SHUT-OFF VALVE. STOP FILLING OPERATION FOR THE TIME BEING WHEN OIL STARTS COMING OUT FROM ALL THE VENTS ON THE CONSERVATOR. CLOSE THESE VENTS, AFTER ENSURING THAT NO AIR BUBBLES COME OUT THROUGH THEM
* CONTINUE OIL FILING TILL OIL STARTS COMING OUT FROM AIR RELEASE VENT ON THE AIR BAG CONNECTION FLANGE ON THE CONSERVATOR. STOP FILLING OIL AND CLOSE THIS VENT AFTER ENSURING NO AIR BUBBLES COME OUT OF IT.
* RELEASE THE AIR PRESSURE INSIDE THE AIR BAG THROUGH THE BREATHER CONNECTION ARRANGEMENT AND CONTINUE OIL FILLING UNTIL M.O.G. INDICATES THE DESIRED LEVEL
* REMOVE OIL PUMP AND CONNECT THE AIR BAG TO THE BREATHER FROM BREATHER CONNECTION FLANGE. ALSO CLOSE THE PRESSURE GAUGE CONNECTION VALVE AND REMOVE THE PRESSURE GAUGE ALONG WITH AIR PUMP CONNECTION
* THE SYSTEM IS NOW PROPERLY FILLED. AIR RELEASE VENTS ARE TO REMAIN CLOSED DURING NORMAL OPERATION.
IMPORTANT WARNING
* OIL FILLING IN THE CONSERVATOR AND ALSO DRAINING OPERATIONS WHENEVER REQUIRED MUST BE CARRIED OUT VERY SLOWLY. DURING OIL FILLING PRESSURE IN THE AIR BAG MUST NEVER EXCEED 0.1 KG/CM (1.5 PSI)
* IF A PRESSURE OR VACUUM IS REQUIRED TO BE APPLIED ANYTIME TO THE MAIN TANK, THE CONSERVATOR MUST BE DISCONNECTED AND A BLANKING PLATE FITTED ON THE SHUT OFF VALVE.
* NO WELDING OPERATORS SHALL BE CARRIED OUT ON THE CONSERVATOR WITH THE AIR BAG FITTED IN ORDER TO AVOID DAMAGE TO THE AIR BAG.
* ONCE ALL THE AIR HAS BEEN REMOVED FROM THE CONSERVATOR DURING OIL FILLING OPERATIONS DO NOT OPEN THE AIR RELEASE VENTS AS OTHERWISE AIR WILL BE SUCKED INSIDE THE CONSERVATOR.

ANNEXURE-B sh-1/2

Provision for SCADA operation

The following features are to be added in RTCC & DM (where necessary) for interfacing SCADA signal as per enclosed schematic drawing (Annexure - B) :-

1) Seperate Terminal Block (X1 as in the drg.) is to be provided for SCADA operation. (i.e. SCADA Terminal Block (STB)).
2) OLTC Control Supply, 110 V AC is to be wired to STB (A1 in the drg.).
3) OLTC 3 – phase main supply for motor MCB in DM is to be of 3- pole / 4 – pole type with at least 1 (one) no. 'NC' auxiliary contact. The auxiliary contact is to be wired to STB for OLTC motor supply fail indication (A2 in the drg.)
4) 'NC' contact of Under Voltage (U/V) Relay is to be wired to STB for OLTC Control Supply fail indication (A3 in the drg.).
5) One 110 V AC relay / contractor actuated by contacts of raise & lower contractors is to be provided for Tap-changer-in-progress indication to SCADA end . 'NO' contact of the relay is to be wired to STB (A4 in the drg.)
6) One Two - position (Sub- stn. / SCADA) stay put **lockable type** Selector Switch having 4 nos. 'NO' and 4 nos. 'NC' auxiliary contacts in each position is to be provided in the remote path of Local / Remote switch . Sub-stn. position of the said selector switch should mean operation of Tap – changer from sub-stn. control room (Remote) and in SCADA position it is operation of Tap - changer from SCADA end. Necessary wiring from the Sub-stn / SCADA selector switch are to be terminated to STB both for operation of Tap – changer as well as indication (A5 in the drg.) of the selected position.
7) 'NO' contact of OSR / TDR is to be wired to STB for tap- changer out – of – step indication (A6 in the drg.) .
8) 3 nos. wires are to be wired up from remote Tap Position Indicating device at DM to STB to facilitate Tap position indicatioin to SCADA end (A7 in the drg.).

Sufficient space closed to SCADA Terminal Block (STB) in RTCC panel should be available for mounting 2 nos. D.C. Contractor used for receiving command for for tap changing operation from SCADA control centre . SCADA Terminal Block should be provided with sufficient spare terminals (Ten nos. or more).

5/6/12

ANNEXURE-B sh-2/2

Schematic diagram for SCADA operation

X1 Terminal Block Details for interfacing SCADA signal from RTCC

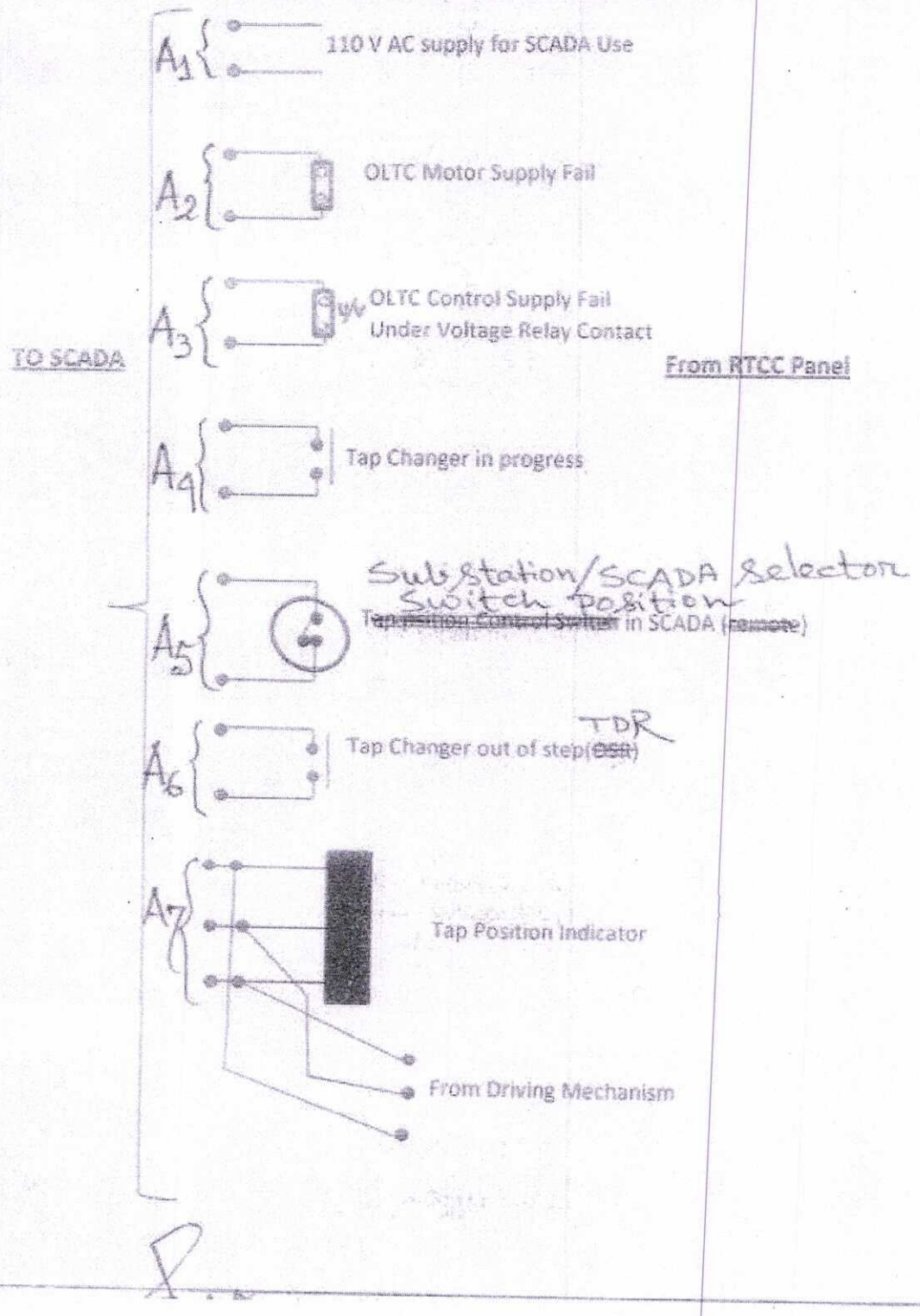
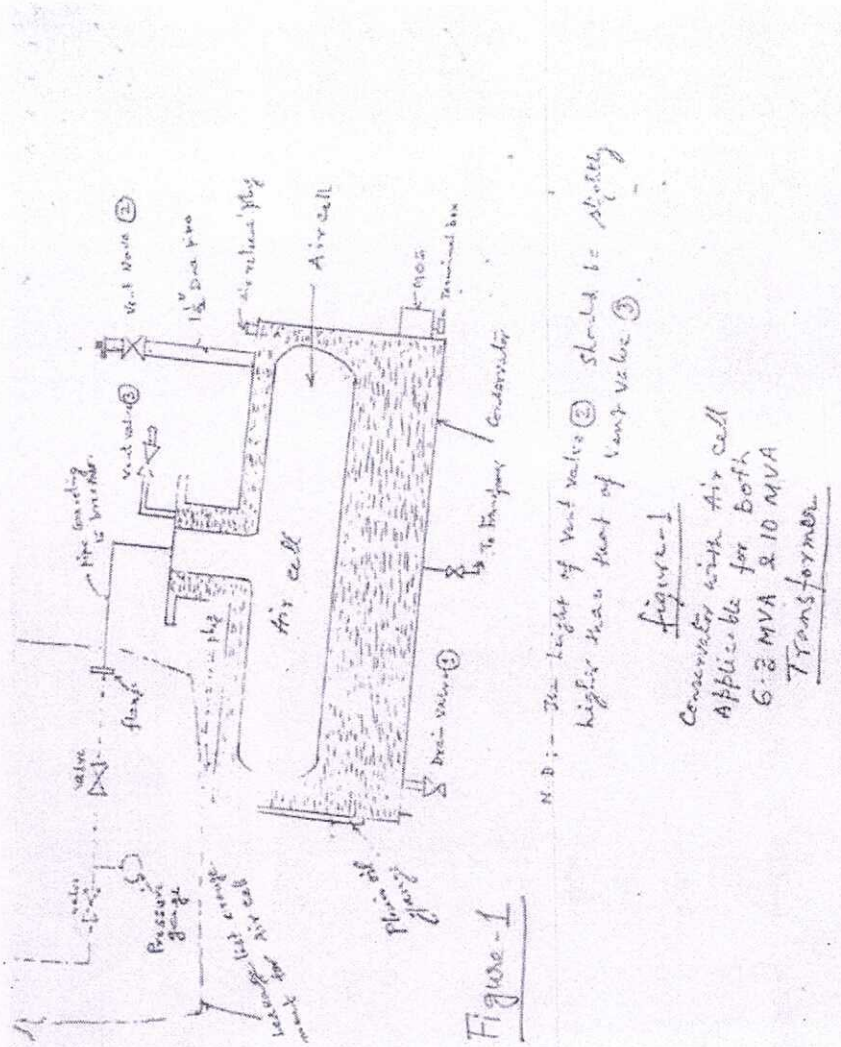


FIGURE-1



N.B:- The height of vent valve ② should be atleast higher than that of temp valve ③.

Figure-1
Conservator with Air cell
Applicable for both
6.3 MVA & 10 MVA
Transformer