

SPECIFICATION FOR OIL FILLED DISTRIBUTION TRANSFORMERS

Scope:-

- 1.1 This specification covers design, manufacturing, testing and delivery of the oil immersed, Oil Natural Air Natural (ONAN) outdoor type, three phase, 50 Hz Transformers with On Load Tap Changer (OLTC) and Remote Tap Change Control (R.T.C.C.) panel, for use in Sub-distribution systems. The ratings are as follows:-
 - 1.1.a) 11/0/415KV, 2MVA outdoor type distribution transformer
- 1.2 The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.
- 1.3 It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements. The dimensional drawings attached with this specification and the notes thereto are generally of illustrative nature. In actual practice, notwithstanding any anomalies, discrepancies, omissions, incompleteness, etc. in these specifications and attached drawings, the design and constructional aspects, including materials and dimensions, will be subject to good engineering practice in conformity with the required quality of the product, and to such tolerances, allowances and requirements for clearances etc. as are necessary by virtue of various stipulations in that respect in the relevant Indian Standards, IEC standards, I.E. Rules, I.E. Act and other statutory provisions.
- 1.3 The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.
- 1.4 Tolerances: Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian/IEC standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality.
- 1.5 Bidder should have Annual Turnover of at least amount specified in the qualification criteria under the bidding document. It has to be supported by the balance sheet of past three years which need to submit along with offer for evaluation.

STANDARDS APPLICABLE

The transformer shall comply with the latest edition of the following and other relevant Indian Standards

IS : 335		Insulating Oil
IS : 1271	:	Classification of insulating materials
IS: 2026 (Part – I) / IEC Pub. 76	:	Power Transformer – General
IS : 2026 (Part – II) / IEC Pub. 76	:	Power Transformer – Temperature rise
IS : 2026	:	Power Transformer – Insulation level and (Part III) dielectric tests
IS : 2099	:	High Voltage Porcelain bushing screen
IS : 2705 (Part I & III)	:	Current Transformers
IS : 3202	:	Core of practice for climate proofing
IS : 3639	:	Power transformer fittings and accessories
IS : 6600	:	Guide for loading of oil immersed transformer

GENERAL CONSTRUCTIONAL FEATURES

1.1 All material used shall be of best quality and of the class, most suitable for working-under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over-excitation, short-circuits as per specified standards, without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform. Transformer shall be of proven design and hence each of the proposed number of Transformer of Each ratings shall be :-

1.1.a - Subjected to temperature rise test & Impulse test

1.1 .b - Short circuit report of similar or higher rating needs to produced.

1.2 Tanks

The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct color from the prime and finish coats. The final coat shall be of a flossy, oil and weather resisting non-fading paint of specified shade. The interior of the tank shall be cleaned by shot blasting and painting with two coats of heat resistant and oil insoluble paint.

1.3) Steel bolts and nuts exposed to the atmosphere shall be galvanized.

1.4) Unless otherwise stated, the tank together with radiators, conservator, bushings and other fittings shall be designed to withstand without permanent distortion the following conditions:

a) Full vacuum of 760 mm of Hg, for filling with oil by vacuum.

- b) Internal gas pressure of 0.35 Kg/cm² (5 lbs/sq.in) with oil at operating level.
- 1.5 The tank cover shall be suitably sloped so that it does not retain rain water.
- 1.6 The material used for gaskets shall be cork neoprene or approved equivalent.

Core:-

1.5) Transformer shall be double wound ,core type with low loss, non ageing ,high permeability PRIME GRADE , CRGO with M4 Grade or Better, perfectly insulated and clamped to minimize noise and vibrations. Followings should be Mandatory for any Manufacturer:-

- 1) Transformer shall be of **BOLTLESS** core design.
- 2) Core shall be purchased **Directly from Manufacturer or from their accredited Marketing organization of Repute & not through any agent. Bidder has to submit manufacturer's name during bidding having sufficient credential & Core has to be purchased from the approved manufacturer.**
- 3) Stage inspection of the core shall be done at manufacturer's premises & inspection call shall be given with following Documents
 - a) Invoice of the supplier
 - b) Mill's test certificate
 - c) Packing list
 - d) Bill of landing & Bill of Entry certificate by customs
- 4) Transformer manufacturer should have in-house core cutting facilities for proper control & monitoring of quality & to avoid mixing of Prime core with Second grade /defective core materials. Transformer Manufacturer should have in house slitting Machine so that core is cut to width & stacked with minimum air gap thus ensuring Burr level less than 10Microns .
- 5) The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000V for one minute.

Windings

- 1.6) Winding shall be made with 99.9% pure electrolytic grade copper / 99% pure Aluminum insulated with high grade paper Insulation. Manufacturer shall provide preferably foil windings for LV coils so as to reduce the stray loss and overall surface area. The HV & LV winding should be able to withstand thermal and mechanical stress in the event of short circuit.
- 1.7) Winding shall be carried in dust free area.
- 1.8) The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

Internal Earthing

- 1.9) The framework and clamping arrangement of core and coil shall be securely earthed inside the tank by copper strap connection to the tank.

Termination

- 2.0) Transformers shall be fitted either with bushing insulators or with cable boxes / cable box with disconnecting chambers. The Cable Boxes shall be suitable for termination 3 Runs of 300Sq.mm XLPE cable.
- 2.1 The neutral of the star-connected winding shall be brought out to a separate bushing terminal. The neutral bushing shall be provided on the tank side to facilitate lead of the earth conductor down to the ground level. For transformers 1000 KVA and above, tank mounted pin

type support insulators shall be provided for supporting the neutral earthing bar of specified section, along its run from the neutral bushing to ground-level.

Bus Duct Termination

2.2) When bus-duct termination is specified , a flanged bushing connection shall be provided to suit the PURCHASER'S bus-duct. The winding terminations shall be brought out on outdoor type of bushings.

Bushings

2.3) Bushings shall be designed and tested to comply with the applicable standards specified in Data sheet A. If type test certificates are not available, these tests shall also be carried out in addition to the routine tests.

2.4) Bushing rated for 400A and above shall have non-ferrous flanges and hardware.

2.5) Fittings made of steel or malleable iron shall be galvanized.

2.6) Whenever specified in Data Sheet A, bushings shall be supplied with terminal connector clamp suitable for connecting the terminal bushing terminal to the PURCHASER's specified conductor.

Bushing Current Transformers

2.7) Whenever specified, bushing shall be supplied with current transformers.

2.8) Secondary leads, including tapings, shall be brought to a weatherproof terminal box near the bushing.

2.9) Bushing C.T. nameplate shall be mounted on the tank adjacent to the terminal box.

Cable Boxes and Disconnecting Chamber

3.0) When specified, cable boxes shall be supplied to suit the PURCHASER'S specified cables. The cable boxes shall be complete with cable joint fittings or sealing ends as required, tinned copper lugs to suit specified cable, compound and all other accessories including double compression type glands, armor earth clamps and body earth terminal.

3.1) When specified, disconnecting chamber shall be provided to enable the transformer to be removed without unsealing the cables or draining oil from the main tank. The disconnecting chamber shall be air insulated and complete with seal-off bushings, removable flexible connectors/links and removable covers.

3.2) Phase to phase and phase to ground clearances within the chamber shall be such as to enable either the transformer or cable to be subjected separately to H. V. tests. Clearances shall be subject to the PURCHASER's approval.

Marshalling Box

3.3 Whenever optional fittings (e.g. temperature indicators with auxiliary contacts, Buchholz relay) and bushing CT are specified in Specs , the VENDOR shall provide a marshalling box and marshal to it all the contacts/terminals of electrical devices mounted on the transformer. It shall be in the VENDOR'S scope to provide:

a) the interconnection cabling between the marshalling box and the accessory devices by either PVC insulated wires in GI conduits or PVC insulated armored cable and

b) necessary compression type, brass cable glands at the marshalling box for the above mentioned cables as well as for terminating the PURCHASER'S incoming cables from remote panels.

3.4) The marshalling box shall be tank mounted, outdoor, weather-proof, sheet-steel (2 mm thick) enclosed, with hinged door having padlocking facility and painted as per clause 3.2. All doors, covers and plates shall be fitted with neoprene gaskets. Bottom shall be at least 600 mm from floor level and provided with gland plate and cable glands as required. Top surface shall be sloped.

3.5) All contacts for alarm, trip and indication circuits shall each be electrically free, wired for auxiliary D.C. supply as specified and brought out to separate terminals at the terminal blocks in the marshalling-box. Terminals shall be rated for 10A. Wiring shall be with stranded, copper conductors of sizes not smaller than 1.5 sq.mm for control and 2.5 mm for C.T. circuits. C.T. terminals shall be provided with shorting facility.

4.0 ELECTRICAL AND PERFORMANCE REQUIREMENTS

4.1) Transformers shall operate without injurious heating at the rated KVA at any voltage within + 10 percent of the rated voltage of that particular tap.

4.2 Transformers shall be designed for 110% continuous over fluxing withstand capability.

4.3 Overloads shall be allowed within the conditions defined in the loading guide of the applicable standard. Under these conditions, no limitations by terminal bushings, tap/changers or other auxiliary equipment shall apply.

5.0 OIL

5.1) Transformer oil shall be as per **IS-335:1993**. It shall be **“PCB free and polycyclic Aromatic Hydrocarbons free mineral oil”**. The material safety Data Sheets (MSDS) for the Transformer oil shall be submitted by the bidder along with the offer.

5.2) The Transformer oil used should be fresh and new. Vendor shall submit all the required documents to purchaser during stage inspection of oil to ensure oil getting used is not recycled one. In case recycled oil found to be used, the purchaser may cancel the contract of Vendor.

6. Off Circuit Tap Changing Mechanism

It shall comprise:

a) Operating handle or wheel, accessible from ground level.

b) Tap position indicator.

c) Pad locking arrangement.

d) The tap-changer connections and contacts shall be accessible through an excess hole having a bolted gasketed cover.

7. The routine and type test requirements of transformers shall be as follows:-

7.1) All the transformers shall undergo Routine test as per IS 2026

7.2) Pressure & Vacuum test needs to be carried out on 1 unit of each rating.

7.3) Noise level test needs to be carried out on 1 unit of each rating.

7.4) Heat run and Impulse test shall be carried out on 1 unit of each rating.

7.5) One transformer of each rating, selected randomly from the lot shall be sent for measurement of losses, declared by vendor (on data sheet) at third party / any NABL

accredited lab.. In case loss figures deviates more than tolerances specified in IS 2026, purchaser reserves rights of terminating the contract of vendor.

8.0 LOSSES :-

8.1) Preferred losses shall be in accordance with below table:-

Sr.No	RATINGS -KVA	NLL / LL/ % Z (IS Tol) - 11KV/ 6.6KV (KW)	NLL / LL/ % Z (IS Tol) - 33KV (KW)
1	400	0.7/7.5/4.5%	0.95/7.5/4.5%
2	500	0.9 / 8/ 4.5%	1.2 / 8 / 4.5%
3	630	1.1 / 10 / 4.5%	1.3 / 9 / 4.5%
3	750	1.2 / 11 / 5%	1.4 / 11.0 / 5%
4	800	1.2 / 12/ 5%	1.4 / 12.0 / 5%
5	1000	1.5/ 13.5 / 5%	1.6 / 14 / 5%
6	1250	1.6 / 16 / 5%	2 / 17 / 5%
7	1500	1.8 / 19/ 6.25%	2.1 / 19 / 6.25%
8	1600	1.9/ 19 / 6.25%	2.2 / 21 / 6.25%
9	2000	2.2 / 24 / 6.25%	2.6 / 24 / 6.25%
10	2500	2.7 / 28 / 6.25%	3.2 / 27 / 6.25%

All the measurement of losses shall be carried out by digital meters of class 0.5 or better accuracy and should be certified by the manufacturer. If the losses measured are found to be out of tolerance band as stated in Standard and guaranteed losses declared by manufacturer, the same shall be attributed to the manufacturer as per capitalization formula till the end of warranty period. In extreme conditions the customer has got holds absolute rights to reject the lot and terminate the contract of vendor.

8.2 For the purpose of evaluation of bids, the quoted load losses and iron losses shall be increased to take into consideration tolerance as permitted by applicable standard.

8.3 Should the losses as measured on the transformer after manufacture be found in excess of the values of the guaranteed losses with plus tolerance indicated in the proposal, the whole contract with Vendor will get terminated.

9. GENERAL INSULATION LEVEL:-

Voltage Level	One Min Power Frequency Withstand Voltage (KV)	Impulse Withstand
11KV	28KV	75KV _{Peak}
22KV	50KV	125KV _{Peak}
33KV	75KV	175KV _{Peak}

DATA SHEET (A): - SPECIFIC REQUIREMENT

1	Name of manufacturer	<i>Bidder to Provide</i>	
2	KVA Rating		
3	No of phase and rated frequency	3 phase , 50 HZ	
4	Rated voltage (kV)		
	HV	<i>11KV</i>	
	LV	<i>433V</i>	
5	Connection		
	HV	STAR	
	LV	DELTA	
	VECTOR GROUP	<i>DYN11</i>	
6	Winding		
a	HV	<i>Copper</i>	
b	LV	<i>Copper</i>	
7	Insulation level (Impulse withstand)(kVpeak)		
a	HV	<i>50KV peak</i>	
b	LV	<i>NA</i>	

8	Insulation level (power frequency withstand) (kVrms)		
a	HV	<i>28KV rms</i>	
b	LV	<i>3KV rms</i>	
1 0	Tapping	<i>OCTC</i>	
a	Range	<i>+5% to -5% @ 2.5%</i>	
b	No of Steps	<i>4</i>	
c	On HV	<i>Yes</i>	
d	Tap changer type	<i>OCTC</i>	
1 1	Temperature rise of oil/winding over design ambient temperature of 50(°C)	<i>45/50 Degree Celcius</i>	
1 2	Hot spot temperature rise over a maximum yearly weighted temperature of 32 °C	<i>98 Degree Celcius</i>	
1 3	Short circuit Thermal withstand time secs	<i>25KA for 1 sec</i>	
1 4	% Impedance at 75°C, rated current &Frequency % (subject to IS tol)	<i>As per table in clause no 9</i>	
1 5	No load loss at rated voltage &frequency kW (subject to IS tol)	<i>As per table in clause no 9</i>	
1 6	Load loss at rated current&75°C kW (subject to IS tol)	<i>As per table in clause no 9</i>	
1 7	Efficiency (%)		

a	100 % load	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
b	75% load	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
c	50% load	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
1 8	% Load at which Max Efficiency occurs (%)	<i>Bidder to Provide</i>	
1 9	Maximum Efficiency (%)	<i>Bidder to Provide</i>	
2 0	Regulation at full load 0.8pf% (%)	<i>Bidder to Provide</i>	
2 1	Regulation at full load upf% (%)	<i>Bidder to Provide</i>	
2 2	Bushings		
a	Reference standard	-	
b	Type of bushing	<i>PORCELAIN</i>	<i>EPOXY</i>
c	Voltage Rating kV	<i>12KV</i>	<i>1.1KV</i>
d	Current Rating Amps	<i>250A</i>	<i>1000A</i>
2 3	Weight in Kgs (Approximate)	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
a	Core and winding	<i>Bidder to Provide</i>	
b	Tank &Fittings	<i>Bidder to Provide</i>	
c	Oil	<i>Bidder to Provide</i>	

d	Total weight	<i>Bidder to Provide</i>	
2 4	Approximate Overall dimension (in mm)	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
a	Overall Length	<i>Bidder to Provide</i>	
b	Overall breadth	<i>Bidder to Provide</i>	
c	Overall Height	<i>Bidder to Provide</i>	
2 5	Approximate Weight of Heaviest package (KG)	<i>Bidder to Provide</i>	
2 6	Approximate transport dimensions LxBxH (mm)	<i>Bidder to Provide</i>	
2 7	Fitting & Accessories as per specification	<i>Bidder to Provide</i>	
2 8	Reference standard	<i>Bidder to Provide</i>	
2 9	Termination	<i>Bidder to Provide</i>	<i>Bidder to Provide</i>
a	HV	<i>BARE BUSHINGS</i>	
b	LV	<i>CABLE BOX</i>	
	Orientation HV -LV	<i>180 Degree</i>	

LIST OF ACCESSORIES REQUIRED:

STANDARD FITTINGS

Details	Qty.
Conservator with oil filling hole with bolted cover plate and drain	1

plug	
Prismatic Oil Level Gauge	1
Silicagel Breather with Oil Seal	1
Rating & Diagram plate	1
Monogram Plate	1
Storage instruction Plate	1
Explosion vent with single diaphragm	1
Thermometer pocket. (without thermometer)	1
Top filter valve	1
Drain cum bottom filter Valve	1
Air release Plug	1
Inspection Cover	1
Cover lifting lugs	2
Lifting Lugs	2/4
Earthing Pads	2
Bidirectional Plain Rollers	4

OPTIONAL FITTINGS REQUIRED

Buchholz Relay - With 2 Set of Contact (Alarm + Trip)	1
Oil Temperature Indicator(OTI)- 150mm Dial - With 2 Set of Contact (Alarm + Trip)	1
Winding Temperature Indicator(WTI)- 150mm Dial - With 2 Set of Contact (Alarm + Trip)	1
Pressure Release Valve (PRV) with One Set of Trip Contact	1
Magnetic Oil Level Gauge (MOLG) with One Set of Alarm Contact	1
Marshalling Box - Containing OTI & WTI as per above	1