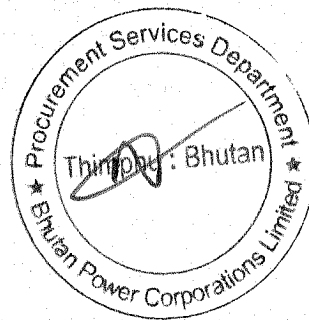


TECHNICAL SPECIFICATIONS

**Lot 3: DISTRIBUTION TRANSFORMERS, 11kV
AND**

Lot 4: DISTRIBUTION TRANSFORMERS, 33kV



A. Scope

This Specification covers the design, manufacture, testing and inspection, packing, shipping, delivery, and performance requirements of outdoor 33 kV and 11kV three phase and single phase distribution transformers.

Any departure from the provisions of this Specification shall be disclosed in the Schedule of Non-Compliance of this document.

Transformer Weights and Special Bracing of Windings

Bidders, please note:

a) Transformer winding shall be so braced / fitted internally to protect the windings against excessive movement and vibration during transportation and particularly during hand cartage to site.

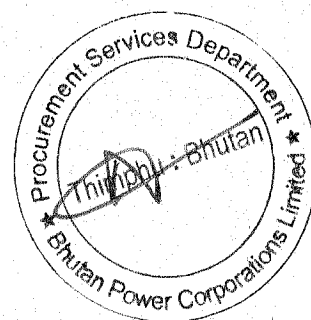
Standards

The transformers shall conform to the latest version of the following IEC Standards:

- IEC 60076 Power Transformers.
- IEC 60137 Insulating bushings for alternating voltages above 1000 V.
- IEC 60296 Specification for unused mineral insulating oils for transformers and switchgear.
- IEC 60354 Loading guide for oil-immersed power transformers.
- IEC 60529 Degrees of protection provided by enclosures (IP Code).
- IEC/TR 60616 Terminal and tapping markings for power transformers.

Losses

The fixed (iron) and running (copper) losses shall be as low as possible, consistent with reliability and economical use of materials. The supplier shall provide the guaranteed values of losses in the Schedule of Technical Particulars enclosed with the Bid document.



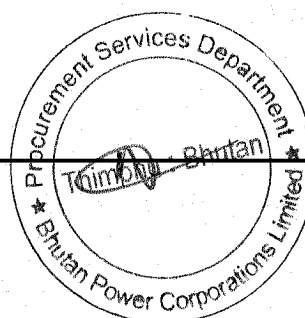
Maximum losses of the transformer should be as follows:

SL#	DESCRIPTION	Max losses	
		No Load Losses (kW)	Load Losses (kW)
(A) 11/0.415 kV System			
1	1250 kVA Transformer	2	14
2	1000 kVA Transformer	1.4	10.4
3	750 kVA Transformer	1.2	8
4	500 kVA Transformer	0.9	5
5	250 kVA Transformer	0.530	2.850
6	125 kVA Transformer	0.3	1.7
7	63 kVA Transformer	0.150	1.1
8	25 kVA Transformer	0.08	0.615
9	16 kVA Transformer	0.065	0.425
(B) 33/0.415 kV System			
1	1250 kVA Transformer	2.5	16
2	1000 kVA Transformer	1.8	12
3	750 kVA Transformer	1.55	10.5
4	500 kVA Transformer	1.1	7
5	250 kVA Transformer	0.55	3.50
6	125 kVA Transformer	0.30	1.70
7	63 kVA Transformer	0.175	1.3
8	25 kVA Transformer	0.125	0.425

Bidders are to design the transformer based on the above losses only and no tolerance will be permitted beyond the above values. Those bidders who do not meet the above losses will be rejected.

Quality Assurance

The manufacturer must operate a quality assurance system that complies with ISO Series 9000. The Supplier shall provide current certification showing the manufacturers' compliance with ISO Series 9000 or equivalent national standard. The certificate must be issued by an independent, accredited issuing authority.



B. TECHNICAL SPECIFICATIONS

i. General

This specification represents the minimum requirements for the works. The Supplier shall provide equipment, which meets or exceeds these minimum requirements. These items are being sought as additions to existing networks; it is essential to maintain compatibility with existing hardware and line design, as well as with established local work practices and methods.

ii. Tests and Test Certificates

All tests shall be carried out in accordance with IEC 76; routine tests, type tests, if certificates unavailable, as well as any agreed special tests. A satisfactory service history of approximately 5 years is preferred, for all plant items.

iii. Operating Characteristics

In addition to the common technical requirements specified, the following minimum operating characteristics shall apply to all the distribution transformers covered in this Specification:

Parameter	Requirement
Applicable standard	IS 2026, IEC 60076
Type	Oil filled / two winding
Winding material	Copper
Core Material	CRGO silicon steel
Cooling	Oil natural air natural (ONAN)
Terminations <ul style="list-style-type: none">• Primary• Secondary	Outdoor Bushing or cable box ¹ Outdoor Bushing or Cable box
Rated no load voltage <ul style="list-style-type: none">• Primary• Secondary	33 kV or 11 kV 415 V
% Impedance 25 kVA-630 kVA	4%
Vector group	Dyn11
Tap changer <ul style="list-style-type: none">• Type	Off load

Parameter	Requirement
<ul style="list-style-type: none"> • Range • Step value 	+5% to -5% 2.5%
Insulation Class (IEC-76)	A
Permissible Temperature rise <ul style="list-style-type: none"> • Maximum winding temperature • Max. Top oil temperature 	55°C 50°C
Insulation levels <ul style="list-style-type: none"> • Primary • Secondary 	170 kVp-70 kV/75 kVp-28 kV 7500 Vp-3000 V
Min. Clearances between Bushing (Outdoor) <ul style="list-style-type: none"> • HV phase to phase/phase to earth • LV phase to Phase/phase to earth 	351/320 mm (33 kV), 280/140 mm (11 kV) 40/75 mm
Min. Clearances between Bushing (Indoor) <ul style="list-style-type: none"> • HV phase to phase/phase to earth • LV phase to Phase/phase to earth 	350/222 mm (33 kV), 130/80 mm (11 kV) 25/20 mm
H.T Bushings <ul style="list-style-type: none"> • 12 kV bushings • 36 kV bushings 	Conforms to I.S: 3347 Part III(Sec 1&2) Conforms to I.S: 3347 Part V(sec 1&2)
Maximum allowable noise level	As per IEC 551

Note 1: Bushing for pole mount and cable for pad mount as per the specific requirement at site.

Note 2: Above values are standard values at 1000 meters ASL. For installing at an altitude higher than 1000m, the insulation withstand level of external insulation and the clearances shall be defined by the bidder considering altitude correction factor.

iv. Construction

The transformers shall be double-wound, oil immersed, naturally cooled (ONAN), oil types either hermetically sealed, or conventional type with tank breathers.

All turns of windings shall be adequately supported top and bottom, to prevent movement. In cases where turns are spaced out, a suitable inter-turn packing shall be provided. The

insulation between core and bolts and core and clamps shall withstand 2,000V for one minute.

No material which can be deleteriously affected by the action of oil under the operating conditions of the transformers shall be used in the transformers or leads or bushings.

v. Transformer Tank and Covers

The transformer tank and covers shall be fabricated from sheet steel and shall be of robust construction. All welds shall be made by the electric arc process. With the exception of radiator elements, all external joints shall be seam welded. Cooling radiators shall be of robust and simple construction.

All matching faces of joints to be made oil tight shall be finished with a smooth surface to ensure that the gasket material will make a satisfactory joint. Bolts shall be spaced at sufficiently close intervals to avoid buckling of either flange or covers and provide reasonably uniform compression of the gasket.

Each transformer shall be provided with a minimum of two closed lifting lugs. The minimum diameter of the hole or width of the slot shall be 25 mm. The two lifting lugs shall be so located that there will be a minimum clearance of 100 mm between the lifting chain and the nearest part of the bushings. Oil conservators are not mandatory, but the bidder must state whether his bid includes or excludes oil conservators. Transformers, other than hermetically sealed types, shall be fitted with oil draining and oil filling gate valves, plus a breather. An oil level sight glass shall be fitted marking the cold oil level.

Transformers 25kVA and below will be mounted on pole platform structures with four 30 mm dia bolts spaced 400 mm centre-centre for transformers and spaced 500 mm centre-centre for transformers above 63kVA capacity.

The 2 holes on the same channel should be spaced 227 mm centre-centre for transformers up to and including 25kVA and spaced 242 mm centre-centre for transformers above 25kVA capacity.

vi. Transformer Sealing

For sealed units, a satisfactory lid sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level mark shall be provided inside each transformer marked C.O.L.

vii. Internal and External Finish

Internal and external tank and radiator surfaces shall be thoroughly cleaned by shot blasting or be given an acid and phosphate dip treatment to remove rust and scale and to provide an adherent, moisture resistant coating. Due care shall be given to avoid over pickling, resulting in pitting or unduly heavy deposit of phosphate. This resultant coating shall provide a surface, which shall offer good paint adhesion and a resistance to corrosion. The interior surfaces of the tank and cover, or conservator; above the lowest oil level shall be given one coat of oil and acid resisting paint, after cleaning.

The exterior surfaces of the complete transformer shall, where appropriate, be protected by a paint system which shall be applied strictly in accordance with the paint manufacturer's instructions. The system shall consist of not less than two priming coats and two finishing coats of oil and weather resisting paint.

The total thickness of the paint shall be not less than 0.120 mm with a minimum total thickness of priming and finishing paint of 0.06 mm each. Attention shall be paid to the need to achieve adequate coverage at metal edges, where breakdown of the paint film often begins. The paint system and the colour of the final coat shall be dark grey colour.

Attention shall be paid to the need to achieve adequate coverage at metal edges, where breakdown of the paint film often begins.

The paint system and the color of the final coat shall be subject to the approval of the Purchaser and preferably be a dark grey color.

i. Rating Plate

A stainless steel rating plate, of at least 1 mm thickness, shall be fitted to each transformer and shall carry all the information as specified in the Standards. The rating plate shall be fitted below the LV terminals.

ii. Terminal Markings

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal.

iii. Tank Marking

Each transformer shall have the kVA rating stencilled on the outside of the tank. The numerals shall be black, 75mm high, and positioned centrally below the HV bushings so as to be readily visible from the ground.

iv. Terminal Leads

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer, to withstand the effects of vibration and handling during transport, hand cartage and short circuits.

v. Bushings

All bushings shall be porcelain clad, and shall be sealed to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing palms shall be made of brass and have one 14 mm dia. hole.

In case of outdoor bushings, the HV terminals shall be fitted with moulded heat shrinkable insulating covers suitable for 50 mm ACSR 'Rabbit' conductor to provide protection of the bushing palm. The LV bushings shall be in a cable box with suitable glands for cable sizes from 16-150 mm².

vi. Arching horns

All the transformers shall be equipped with arching horns on HT outdoor bushings.

viii. Earthing Connections

Two earthing connections shall be provided with connection facilities for 25 x 6 mm GI strip. The bolts shall be located on the lower side of the transformer and be of M12 size. Each connection shall be indicated clearly with an engraved 'earth' symbol.

ix. Gaskets

Gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects on either gaskets or oil when the gaskets are continuously in contact with hot oil. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight/UV. The material for gaskets shall be cork, neoprene or equivalent.

x. Drying Out, Filling, Transformer Oil

All transformers shall be thoroughly dried out at the manufacturer's works. Oil immersed

type transformers shall be delivered filled with oil to normal level, ready for service, except that conservators may be removed for transport.

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil in compliance with BS148/IEC-60296 and shall be free from all traces of polychlorinated biphenyl (PCB) compounds.

xi. Fittings

The following standard fittings shall be provided:

- Rating and terminal marking plates non-detachable of aluminium material
- Earthing terminals with lugs - 2 Nos.
- Lifting lugs for main tank & top cover
- Pulling lugs - 4 Nos
- HV bushings with arching horns
- LV bushings inside the cable box as per site requirement and neutral bushings (for high rating transformers).
- Metallic conservator tank (mandatory for 50 kVA and above for rated voltage 11 kV and below, and all ratings above 11 kV) with oil gauge
- Terminal connectors on the HV/LV bushings
- Thermometer pocket with cap.
- Air release device (bolted type) for all transformers fitted with conservator tank
- Radiators
- Prismatic oil level gauge
- Drain cum sampling valve
- Oil filling hole having M30 thread with plug and drain valve on the conservator
- Silica gel breather (25 kVA and above for rated voltage 11 kV and below and all ratings above 11 kV). Type of breather (Bolted type is preferred).
- Pressure relief device or explosion vent.
- Metallic off-load tap changer
- Base channel ISMC 125 x 65 mm with M16 bolts and nuts to fix on mounting platform (for pole mounted stations, spacing of the holes to be decided base on pole type (steel tubular / telescopic pole).
- MCCB at LT side inside a cable box for transformers rated 250 kVA and below.
- ACB at LT side inside a cable box for Transformer rated 500kVA.

Pad mounted transformers below 500 kVA shall have skid type under base channels having towing holes for pulling & mounting holes for foundation of transformer. For heavy transformers of 500kVA and above, the under base shall be equipped with rollers allowing the unit to be manoeuvred into final position and then anchored.

xii. Radio Interference

When operated at voltages up to 10% in excess of the normal system rating, transformers shall be substantially free from partial discharges; i.e., corona discharges in either internal or external insulation, which are likely to cause interference with radio or telephone communications.

xiii. Packing

Wooden pallets shall be provided for each transformers suitable for international transport and delivery to the Purchaser's warehouse. Bushings and other parts liable to damage shall be additionally protected. The transformers shall be securely bolted to pallets suitable for handling by forklift. In addition, the normal lifting eyes shall be accessible with handling by slings from a crane.

Providing of crate shall be at the discretion of the supplier. In case, if the crate is provided for protection, then each crate shall be clearly marked with the rating and voltage of the transformer, and the total transport weight.

C. TEST STANDARDS

The supplier shall carry out a comprehensive inspection and testing program during manufacture of the equipment. The test shall be carried out as per IEC 60076 Standard for routine, type and special test [as agreed by the Manufacturer and the Purchaser]. This is however not intended to form a comprehensive program as it is supplier's responsibility to draw up and carry out such a program in the form of detailed quality plan duly approved by purchaser for necessary implementation.

