Technical Specification of 100 kVA and 50 KVATransformers

Clause No	Requirements	Bidders shall state as: Fully compliant/Partially compliant/Non-Compliant
1.	**General** The transformer shall be suitable for outdoor pole mounting and shall be designed to facilitate easy operation, inspection, maintenance and repair.	
2	**Capacity of Rating** The Rating of the distribution transformer shall be as indicated below Rated power : 100 KVA and 50 KVA TRANSFOREMR Phase : Three Rated frequency : 50 HZ +/_ 2% Voltage Ratio : 11000/400-230 V at no load Vector group : DYN 11 with neutral at L.V side Cooling : ONAN Insulation class : A	
3	**Service condition** The transformer shall be capable of operating continuously at its normal rating without exceeding the temperature raise limit. The transformer should designed for continuous duty under the following condition Ambient raise temperature: -5 degree Celsius to +45 degree Celsius Installation : Pole mounting	
4	**Transformer core** The core should be constructed of high quality , low loss, high permeability, laser core, non-ageing magnetic silicon steel sheets and design to accessible loading 110% rated voltage without making injury to the transformer core. The steel shall be in thin lamination, annealed after cutting and rolled to insure smooth surface at the edges. Both sides of each sheet shall be insulated with a durable, heat-resistance backed enamel or varnish. The core shall be rigidly clamped with a positive locking devices to insure adequate mechanical strength to support the winding, prevent shifting of laminations during transport and to reduce vibration to a minimum during operation.	
5	**Transformer Windings** The winding shall be made of high conducting electrolytic copper. The design construction and treatment of winding shall give proper consideration to all service factor, such as high dielectric and mechanical strength of insulation coil characteristics, uniform electrostatic flux distribution, minimum restriction to free oil circulation and shall be uniformly insulted. Permanent current-carrying joints for splices shall be welded or brazed, properly formed and	

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Technical Specification of 100 kVA and 50 KVATransformers

Clause No	Requirements	Bidders shall state as: Fully compliant/Partially compliant/Non-Compliant
	Finished and insulted to confirm to the basic insulation. The completed assembly of core and coils shall be dried in a vacuum sufficient to insure elimination of air and moisture within the insulating structure after the drying process, the assembly shall be immediately impregnated with dry oil insulation.	
6	**Tapping** The primary voltage winding of transformer shall be provided with full capacity externally operated off-circuit tap changers. The tap changer shall be designed for de-energized operation with the operating handle brought out through the cover of the tank. The tapping shall be provided on HV side to give +2.5% by means of manually operated off circuit Tapping switch with a position indicator and a locking device.	
7	**Transformer Oil** The transformer tank and all associated oil-filled equipment shall normally be supplied along with the first filling of oil. The transformer oil shall be well filtered of high dielectric strength free from moisture and acidity and have uniform quality and shall comply with the 148/84 and or ICE 296 standards.	
8	**Transformer Tank** The transformer tank shall be of robust construction in accordance with the best engineering practices. The tank of transformer shall be fabricated from tested quality of mild steel of adequate thickness. The tank shall be suitably stiffened to provide rigidity and to meet the pressure inside the tank due to short circuit current and it shall be oil tight and gas tight. The tank shall be capable of withstanding leakage or permanent deformation, resulting from the system of oil preservation.	
9	**Painting** The interior surface of the tank shall be finished with oil resistant paint. The paint use for tank shall have special heat, oil and weather-resisting properties.	
10	**Accessories** Each transformer shall be equipped with the following Accessories: (1)H.T and L.T bushing with terminal connections (2) Two earthing terminals for tank (3) Oil level gauge with minimum and maximum level. (4) Lifting lugs. (5) Rating and terminal marking plate. (6) Conservator tank drain value with plug. (7) Dehydrating breather (silica-gel) (8) Calculation notice plate.	

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Technical Specification of 100 kVA and 50 KVATransformers

Clause No.	Requirements	Bidders shall state as: Fully compliant/Partially compliant/Non-Compliant
	(9) Skid under base. (10) Oil filling hole and plug. (11) Tap changer. (12) Sludge drain value and plug.	
11	**Rating Plate** The rating plate shall give the following information: 1) KVA rating. 2) Voltage on no load on HV and LV side. 3) Current in HV and LV sides. 4) Phase on HV and LT sides. 5) Type of cooling. 6) Frequency 7) Impedance voltage 8) Vector group 9) Weight of core and winding in kg 10) Weight of oil in kg 11) Volume of oil in liters 12) Total weight of the transformer 13) Name of manufacture and year of manufacture 14) Contract number 15) Customer's name 16) Serial number of transformer 17) No load loss and full load loss 18) Maximum guaranteed temperature of oil in centigrade.	
12	Maximum electrical clearance (external) between phase to phase shall not be less than 255mm and phase to earth shall not be less than 205mm on 11kv side. Minimum electrical clearance (external) between phase to phase shall not be less than 75mm and phase to earth shall not be less than 55mm on 400V side.	
13	No. of coils HV/phase: Single Coil.	
14	The supplier shall submit the catalogue/document and detail drawings which shall clearly mentioned no load loss and full load loss in watts.	
15*	**Certificates**	
15.1	The supplier shall furnished following test reports/certificates along with the bid:	
15.1.1	The offered transformers shall confirmed to Nepal Electricity Authority Test Report Original copy for each transformer.	
15.1.2	Self-deceleration letter from the manufacturer regarding the winding material used in the offered transformers which shall also be verified during factory inspection.	

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Technical Specification of 100 kVA and 50 KVATransformers

Clause No.	Requirements	Bidders shall state as: Fully compliant/Partially compliant/Non-Compliant
15.1.3	The following type test reports including no load test and full load tests performed on the identical units from independent testing laboratory. 1) Temperature raise test 2) Dielectric type test a) Impulses voltage test b) Separate source of AC withstand voltage test	
15.2	The supplier shall furnished following test report/certificates as stated below:	
15.2.1	The following tests be performed on each unit of transformer by the manufacturer before dispatch and submit test-report. 1) Applied voltage test 2) Induced voltage test 3) No load loss and excitation current test 4) Impedance voltage and load loss test 5) Winding resistance measurement 6) Ratio tests. 7) Polarity and phase relation test 8) Tank leakage test 9) Insulation resistance test 10) Separate source power frequency voltage withstand test 11) Dielectric breakdown strength of oil	
15.2.2	Test certificate of each transformer from Nepal Electric Authority (NEA) during delivery. If the parameters (s) indicate in test report is/are not complied with the parameters Technical Specification, the delivery of the transformer shall be rejected.	

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CHAPTER-4: LT TRANSFORMER

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CHAPTER - 4

LT TRANSFORMER

1.0 INTENT

This specification is intended to cover outdoor type oil filled 11/0.4 KV, 100 and 50 KVA transformer.

2.0 SCOPE OF WORK

2.1 Scope of Supply

- Transformers as listed above, with insulating oil, all materials and accessories, and complete in all respects.
- Gland plates, power cable, lugs, anchor bolts and hardware.
- Mandatory & optional spares and special maintenance equipments if any.

2.2 Scope of Service

The scope includes but is not limited to the following items of work to be performed for all equipment and materials furnished under this chapter:

a) Design, manufacturing, shop testing, packing & dispatch
b) Transportation inclusive of insurance and delivery, FOR site basis
c) Unloading, handling, storing, transportation at site up to foundations, oil filling and treatment, erection, testing and commissioning
d) Civil Works
e) Supply of external cables and termination as required.

3.0 General Information

3.1 All temperature indicators, Buchholz relays and other auxiliary devices shall be suitable for 110 V DC Control supply. All alarm and trip Contacts shall also be suitable for connection in 110 V DC Circuits.

3.2 Bidders may specifically note that transformers offered shall conform to dynamic short circuit test and dielectric test as per IEC: 60076. Test report for the same shall be submitted during detail engineering for approval.

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4.0 TECHNICAL REQUIREMENTS

4.1 Core

The core shall be constructed from high grade, non-aging, cold rolled grain-oriented silicon steel laminations. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall be such that the flux density at any tap position with 10% voltage variation from the voltage corresponding to the tap shall not exceed 1.9 Wb/sq-m.

4.2 Windings

The conductor shall be of electrolytic copper, free from scales and burrs.

4.3 Insulating Oil

The oil supplied with transformer shall be unused and have the parameters for unused new oil conforming to IEC: 60296 while tested at oil Contractor's premises, No inhibitors shall be used in oil. Ten percent extra oil shall be supplied for topping up after commissioning in non returnable containers suitable for outdoor storage.

4.4 Terminal Arrangement

a) Bushing terminals shall be provided with suitable terminal connectors of approved type and size for cable/overhead conductors termination of HV side and cable termination on LV side.

b) The neutral terminals of 400V winding shall be brought out on a bushing along with the 433 volt phase terminals to form a 4 wire system for the 400 volt. Additional neutral bushing shall also be provided for earthing.

4.5 Off Circuit Tap Changing Equipment

The tap change switch shall be three phase, hand operated for simultaneous switching of similar taps on the three phases by operating an external hand wheel.

4.6 Marshalling Box

A metal enclosed, weather, vermin & dust proof marshalling box shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have a degree of protection of IP 55 as per IEC: 60947 Part-1.

4.7 Cable boxes

Whenever cable connections are required, suitable cable boxes shall be provided and shall be air insulated. They shall be of sufficient size to accommodate Employer's cables and shall have suitable removable side/top cover to facilitate cable termination and inspection. Cable boxes shall be dust & vermin proof.

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5.0 Inspection and Testing

a) The Contractor shall draw up and carry out a comprehensive inspection and testing program during manufacture and commissioning of the transformer. The program shall be duly approved by the Employer.

b) The Contractor shall carryout all routine tests on the entire transformer as per relevant standards. Type test report shall be submitted for approval during detail engineering.

6.0 Inspection

6.1 Tank and Accessories

a) Physical and dimensional check of transformer tank and accessories.

b) Crack detection of major strength weld seams by dye penetration test.

6.2 Core

a) Physical inspection and check of quality of varnish, if used.

b) Sample testing of core material for checking specific loss, bend properties, magnetization, characteristics and thickness.

c) Check on completed core for measurement of iron loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core.

d) HV Test

6.3 Insulating Material

a) Sample checks for physical properties of the material

b) Check for dielectric strength

c) Check for the reaction of hot oil on insulating material

6.4 Winding

a) Sample check on winding conductor for mechanical properties and electrical conductivity and on installation covering.

b) Sample check on insulation paper for pH value, Bursting strength, Electric strength.

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6.5 **Assembled Transformer**

a) Check complete transformer against approved outline drawing provision for all fittings, finish etc.

b) Jacking test on all the assembled transformers.

6.6 Oil

All Standard tests in accordance with relevant Standards shall be carried out on oil samples taken from the transformer before and after testing of the transformer.

The contractor shall also prepare a comprehensive inspection and testing program for all bought out sub-contracted items and shall submit the same to the Employer for approval. Such program shall include the following components:

a) Buchholz Relay
b) Winding temperature Indicator
c) Bushings
d) Marshaling Box
e) Tap changer switch
f) Oil temperature indicator

7.0 **Factory Test**

7.1 All standard routine tests in accordance with latest issue of IEC: 60076 shall be carried out on each transformer.

7.2 The transformer shall conform to all the type tests in accordance with latest issues of IEC: 60076. The manufacturer shall submit type tests & additional test reports as listed above as already carried out on transformers of identical design for Employer's acceptance. The validity of type test reports shall be remained during factory testing. Following parameters in general shall be ensured for establishment of identical design as per IEC 60076, Part-V.

a) Same Voltage ratio, KVA rating, vector group & impedance.
b) Same conceptual design of core and winding.
c) Same arrangement and geometrical sequence of the main windings.
d) Same type of winding conductors.
e) Same type of main windings.
f) Absorbed power at short circuit (ie rated power/per unit short circuit impedance) between 30% and 130% of that relating to the reference transformer.
g) Axial forces and winding stresses occurring at short circuit not exceeding 120% of those relating to the reference transformer.
h) Same manufacturing process.
i) Same Clamping and winding support arrangement..

7.3 In addition to all type and routine tests, transformer shall also conform to following additional type tests as per IEC: 60076.

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a) Measurement of zero sequence impedance

b) Short circuit test

c) Measurement of acoustic noise level. This shall conform to NEMA standard publication TR-1.

d) Measurement of capacitance and tan delta of transformer winding.

e) Test on oil samples as per IS 60296

7.4 All auxiliary equipment shall be tested as per the relevant IS Test Certificates shall be submitted for bought out items.

7.5 High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

7.6 Tank Tests:

i) Routine Tests: As per IEC: 60076 Part-1 including
ii) Vacuum Tests: As per IEC: 60076 Part-1
iii) Pressure Test: As per IEC: 60076 Part-1

7.7 In addition to the above, the following checks should be carried out at manufacturer's works before dispatch for all transformers:

a) Check for interchangeability of components of similar transformers and for mounting dimensions.
b) Check for proper packing and preservation of accessories like radiators, bushings explosion vent, dehydrating breather, Buchholz relay, conservator etc.
c) Check for proper provision of bracings to arrest the movements of core and winding assembly inside the tank.
d) Test for gas tightness and derivation of leakage rate. To ensure adequate reserve gas capacity during transit and storage.

7.8 The Contractor shall submit a detailed inspection and testing program for field activities, covering areas right from the receipt of material stage up to commissioning stage as per IS : 1886 - Code of practice for installation and maintenance of transformers. The indicative checks and tests are given below.

a) Physical checks on each transformer on receipt at site for any damage or short supply.
b) Tests on oil samples
c) Oil leakage test
d) Physical checks for colour of silica in breather
e) Check for oil level in breather housing, conservator tank, etc.
f) Check for correct operation of all protections and alarms.
g) Insulation Resistance Measurement for Main Winding, control wiring etc.

h) Continuously observe the transformer operation at no load for 24 hours.

8.0 Fittings

The following fittings shall be provided with each transformer covered under this specification.

i) Conservator with drain plug and oil filling hole with blanking plate
ii) Plain oil Gauge
iii) Silica gel Breather
iv) Pressure Relief vent
v) Pocket on tank cover for Thermometer
vi) Valves
vii) Earthing Terminals
viii) Rating & Terminal Marking Plates
ix) Lifting Lugs
x) Rollers
xi) Air Release Plug

The fittings listed above are only indicative and any other fittings which generally are required for satisfactory operation of transformer are deemed to be included.

9.0 Spare Parts

9.1 In addition, the Bidder shall also recommend optional spare parts and maintenance equipment necessary for three (3) years of successful operation of the equipment. The prices of these shall be indicated in respective schedules and these shall not be considered for the purpose of evaluation.

10.0 Technical Specification

S No	Description	Unit	Parameters
1	Rated Capacity	KVA	100 and 50
2	Rated Voltage		
a)	HV	kV	11
b)	LV	kV	0.400
3	Type of Winding		Two Winding
4	Service		Outdoor
5	No of Phases	No.	Three
6	Frequency	Hz	50
7	Type of Cooling		ONAN
8	Impedance at 75 Deg C	%	0.05

S No	Description	Unit	Parameters
9	Tolerance on Impedance	%	±10
10	Duty		Continuous
11	Overload		IEC:60076-7
12	Max. Temp. Rise over an ambient of 50 Deg C		
a)	Oil (Temperature rise measurement by thermometer)	°C	50
b)	Winding Temperature rise measurement by resistance method)	°C	55
13	Windings		
a)	System Apparent Short circuit level (kA)		As per IEC: 60076-Part 1
b)	Winding Connection		
(i)	HV		Delta
(ii)	LV		Star
14	Vector Group		Dyn11
15	Insulation		Uniform
16	Insulation Level	kVrms	
a)	Power Frequency Test Level		
(i)	HV	kVrms	28
(ii)	LV	kVrms	2
17	Basic Impulse Level		
(i)	HV	kVp	75
(ii)	LV	kVp	-
18	Highest voltage (kV) for each winding	kV	12
19	Method of earthing		Solidly earthed
20	Tap changer		
a)	(i) Tap Change		+5% to -10% in step of 2.5% on HV side
b)	(ii) Tap control		Off Circuit Tap Change Switch

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S No	Description	Unit	Parameters
21	HV Bushing		
a)	Rated Voltage	kV	12
b)	Rated current	A	100
c)	Basic Impulse Level (kVp)	kVp	75
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	28
e)	Min. Total Creepage Distance	mm	300
f)	Mounting		Tank / Transformer Body
22	LV & Neutral Bushing		
a)	Rated Voltage	kV	1.1
b)	Rated current	A	1000
c)	Basic Impulse Level (kVp)	kVp	-
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	2
e)	Mounting		Tank / Transformer Body
23	Terminal Details		
a)	HV		Suitable for 11kV Cable or Over Head Conductor
b)	LV & Neutral		Cable Box
24	Min. Clearance in Air	mm	
a)	Ph-Ph (HV/LV)	mm	280/25
b)	Ph-Earth (HV/LV)	mm	140/25

सार श्री कार्यकारी निर्देशकज्यूबाट मिति २०७१।०९।३० मा स्वीकृत भएका

१/०.४ के.भी. तथा ३३/०.४ के.भी. का निम्नानुसार क्षमता भएक
न्सफरमरहरुको Loss Values स्वीकृत गरी निजी तथा साझा ट्रान्सफरमरहरुमा
नें ।

१/०.४ के.भी. का वितरण ट्रान्सफरमरहरुको लागि

S.No.	Rating (KVA)	Load Loss (Watt)	No Load Loss (Watt)	Total Loss (Watt)
1	25	460	75	535
2	50	750	120	870
3	75	1000	170	1170
4	100	1210	220	1430
5	125	1430	255	1685
6	150	1675	295	1970
7	200	2100	365	2465
8	250	2550	455	3005
9	300	3000	550	3550
10	350	3550	650	4200
11	400	4025	745	4770
12	500	5150	960	6110

३३/०.४ के.भी. का वितरण ट्रान्सफरमरहरुको लागि

S.No.	Rating (KVA)	Load Loss (Watt)	No Load Loss (Watt)	Total Loss (Watt)
1	50	800	140	940
2	100	1800	290	2090

(२) IEC 60076-01 (9) Tolerances मा Guaranteed Loss Values हरुमा Manufa
and Measuring uncertainities का कारण निम्नानुसार Tolerances
ट्रान्सफरमरहरु लिन सकिने प्रावधान छ ।

Total Losses - +10% of the Total Losses

Component Losses - +15% of the each component loss, provided t
tolerances for total losses is not exceeded.