

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

SECTION- LT TRANSFORMER

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1.0 INTENT

This specification is intended to cover outdoor type oil filled **33/0.433kV, 1000kVA & 630 kVA, 11/0.433kV, 630 & 250 kVA transformers.**

2.0 SCOPE OF WORK

2.1 Scope of Supply

- a) Transformers as listed above, with insulating oil, all materials and accessories, and complete in all respects.
- b) Gland plates, power cable, lugs, anchor bolts and hardwares.
- c) 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 section:

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

3.0 GENERAL INFORMATION

3.1 All temperature indicators, Buchholz relays and other auxiliary devices shall be suitable for 220 V DC Control supply. All alarm and trip Contacts shall also be suitable for connection in 220V DC Circuits.

3.2 Bidders may specifically note that transformers offered shall conform to dynamic short circuit test and dielectric test as per IS-2026. Test report for the same shall be submitted during detail engineering to KPTCL.

4.0 TECHNICAL REQUIREMENTS

4.1 Core

The core shall be constructed from high grade, nonageing, cold rolled grain-oriented silicon steel laminations. The maximum flux density in any part of the cores and yoke at rated voltage and frequency shall be such that the flux density with +12.5% combined voltage and frequency does not exceed 1.9 Tesla.

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 433V winding shall be brought out on a bushing along with the 433 volt phase terminals to form a 4 wire system for the 415 volt. Additional neutral bushing shall also be provided for earthing with a suitably rated CT for implementing Earth-fault protection.

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 IS: 2147

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 Purchaser's cables and shall have

suitable removable side/top cover to facilitate cable termination and inspection. Cable boxes shall be dust & vermin proof.

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 programme shall be duly approved by the Purchaser.
- b) The Contractor shall carryout all routine tests on the transformers as per relevant standards. Type tests report shall be submitted to KPTCL 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, magnestisation, 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 insulation covering.
- b) Sample check on insulation paper for pH value, Bursting strength, Electric strength.

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 programme for all bought out sub-contracted items and shall submit the same to the Purchaser for approval. Such programme 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 IS: 2026 shall be carried out on each transformer.

7.2 The Type test reports of transformer shall be furnished. The type test reports shall not be older than five (5) years as on the last date of submission of bid. The type tests are to be conducted again without any extra cost to the owner in case the type test reports are older than five (5) years as on the last date of submission of bid. The type test charges are to be indicated in the schedule. The owner reserves right to insist for conducting all or a few type tests even though the type tests are less than five (5) years old as on the last date of submission of bid, the payment in such cases will be made as per the rates in the schedule.

a) For Transformers manufactured in India:

- i. Type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by Government or accredited by National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. Type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.

- iii. The type tests conducted in-house by manufacturers shall also be acceptable where the specific test facilities are not available in independent NABL accredited laboratories provided the lab (manufacturer's) is accredited by National accreditation body of the country and the tests have been witnessed by a representative of NABL accredited Independent laboratory/Power utility.

b) For Transformers manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of respective country.
- ii. Type tests conducted in-house by manufacturers shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests have been witnessed by a representative of accreditation body/Power utility.

7.3 In addition to all type and routine tests, transformer shall also conform to following additional type tests as per IS : 2026.

- 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.

Sequence of testing shall be mutually agreed between Purchaser and Contractor after award.

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:

- a) Routine Tests: As per CBIP Manual on Transformers
- b) Type Tests:
 - i) Vacuum Tests: As per CBIP Manual on Transformers
 - ii) Pressure Test: As per CBIP Manual on Transformers

7.7 In addition to the above, the following checks should be carried out at manufacturer's works before despatch 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 programme for field activities, covering areas right from the receipt of material stage upto 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 hour s.

8.0 FITTINGS

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

- a) Conservator with drain plug and oil filling hole with blanking plate
- b) Plain oil Gauge
- c) Silica gel Breather with pipe connection upto conservator
- d) Pressure Relief vent
- e) Pocket on tank cover for Thermometer for Oil-temperature, Winding temperatures, OTI & WTI with the calibrated detectors
- f) Valves
- g) Earthing Terminals
- h) Rating & Terminal Marking Plates
- i) Lifting Lugs

j) Rollers

k) Air Release Plug on highest points of tank and radiators

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 The list of spares for outdoor type transformers covered under this section shall be as specified in Section-Project

9.2 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 PARAMETERS

Sl. No.	Description	Unit	Parameters	
1	Rated Capacity	kVA	630	1000
2	Rated Voltage			
a)	HV	kV	11	33
b)	LV	kV	0.433	0.433
3	Type of winding		Two winding	
4	Service		Outdoor	
5	No of Phases	No.	Three	
6	Frequency	Hz	50	
7	Type of cooling		ONAN	ONAN
8	Impedance at 75 Deg C	%	0.05	0.05
9	Tolerance on Impedance	%	±10	±10
10	Duty		Continuous	Continuous
11	Overload		IS 6600	IS 6600
12	Max. Temp. Rise over an ambient of 50 Deg C			
a)	Oil (Temperature rise measurement by thermometer)	0C	50	
b)	Winding Temperature rise measurement by resistance method)	0C	55	
13	Winding			
a)	System Apparent short circuit level (kA)		As per IS 2026-Part 1	

b)	Winding connection			
(i)	HV		Delta	Delta
(ii)	LV		Star	Star
14	Vector Group		Dyn11	
15	Insulation		Uniform	
16	Insulation Level			
a)	Power Frequency Test Level			
(i)	HV	kVrms	28	95
(ii)	LV	kVrms	2	
Sl. No.	Description	Unit	Parameters	
17	Basic impulse Level			
(i)	HV	kVp	75	250
(ii)	LV	kVp	–	–
18	Highest voltage (kV) for each winding	kV	12	52
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	
21	HV Bushing			
a)	Rated Voltage	kV	12	52
b)	Rated current	A	100	100
c)	Basic Impulse Level(kVp)	kVp	75	250
d)	Wet & Dry Power frequency Withstand Voltage	kVrms	28	95
e)	Min. Total creepage Distance	Mm	300	1300
f)	Mounting		Tank/Transformer Body	
22	LV & Neutral Bushing			
a)	Rated Voltage	kV	1.1	1.1
b)	Rated current	A	1000	2000
c)	Basic Impulse Level (kVp)	kVp	-	-
d)	Wet & Dry Power frequency Withstand voltage	kVrms	2	2
e)	Mounting		Tank/Transformer Body	
23	Terminal Details			
a)	LV		Suitable for 11kV Cable	Suitable for 33kV Cable

			or Over Head Conductor	or Over Head Conductor
b)	LV & Neutral		Cable Box	
24	Min. Clearance in Air	mm		
a)	Ph- Ph (HV/LV		280/25	530/25
b)	Ph-Earth (HV/LV)		140/25	480/25
25.	a) Maximum losses at 50% loading	Watts	1745	2620
	b) Maximum losses at 100% loading	Watts	4850	7000
	Note: i. For transformers of HV voltage upto 11kV, the total losses at 50% of rated load and total losses at 100% of rated load shall not exceed the maximum total loss values given above. ii. For transformers having voltage class above 22kV and upto and including 33kV, the permissible total loss values shall not exceed by 7½ percent of the maximum total loss values mentioned above.			