

Laboratory	TBEA Energy (India) Private Limited, "TBEA Green Energy Park", National Highway No.8, Village Miyagam, Karjan, Gujarat		
Accreditation Standard	ISO/IEC 17025: 2005		
Discipline	Electrical Testing	Issue Date	24.10.2014
Certificate Number	T-3165	Valid Until	23.10.2016
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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
I. TRANSFORMERS AND REACTORS				
1.	Power Transformers up to 2400 MVA, 765 kV & Reactor Upto 200 MVA, 765 kV	Winding Resistance	IS 2026 (Part 1) : 2011 Cl. 10.2 IEC 60076-1 : 2011 Cl. 11.2 IS 5553 (Part 2) : 1990 Cl. 7.5 IEC 60076-1 : 2011 Cl. 11.2 IEC 60289 : 988 Cl. 8.5	10 mA to 10 A 4 mΩ to 20 kΩ 15 mA to 40 A 0 to 40 kΩ 25 A to 100 A 0 to 3.2 Ω
2.	Power Transformers Upto 2400 MVA, 765 kV	Measurement of Voltage Ratio & Check of vector group	IS 2026 (Part 1) : 2011 Cl. 10.3 IEC 60076-1 : 2011 Cl. 11.3	Ratio : 0.9 to 10000 at 160 V
3.	Power Transformers Upto 2400 MVA, 765 kV	Measurement of No Load Loss & Current	IS 2026 (Part 1) : 2011 Cl. 10.5 IEC 60076-1 : 2011 Cl. 11.5	Current : 0 to 4000 A Voltage : 0 to 200 kV Power : 0 to 5000 kW Frequency : 50 Hz

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4.	Power Transformers up to 2400 MVA, 765 kV & Reactor Upto 200 MVar, 765 kV	Insulation Resistance & Polarization Index	IS 2026 (Part 1) : 2011 Cl. 10.1.3 and CBIP Manual Pub. No.295:2006 IEC 60076-1 : 2011 Cl. 11.1.2.2	Voltage : 100 V to 5 kV Resistance : 10 kΩ to 10 TΩ
			IS 5553 (Part 2) : 1990 Cl. 7.3 (b) IEC 60076-1 : 2011 Cl. 11.1.2.2	Polarization Index : 1
5.	Power Transformers up to 2400 MVA, 765 kV & Reactor Upto 200 MVar, 765 kV	Applied Voltage Test	IS 2026 (Part 3) : 2009 Cl. 11.0 IEC 60076-3 : 2013 Cl. 10	Voltage : 0 to 980 kV Frequency : 50 Hz
			IS 5553 (Part 2) : 1990 Cl. 7.11.1 IEC 60076 (Part 6) : 2007 Cl. 7.8.10.2 IEC 60076 (Part 3) : 2013 Cl. 10	

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6.	Power Transformers up to 2400 MVA, 765 kV & Reactor Upto 200 MVar, 765 kV	Induced Over Voltage with partial discharge measurement & Line Terminal AC withstand Test	IS 2026 (Part 3) : 2009 Cl. 12.0 IEC 60076-3 : 2013 Cl. 11 & 12 IS 5553 (Part 2) : 1990 Cl. 7.11.2 IEC 60076 (Part 6) : 2007 Cl. 7.8.10.3 IEC 60076 (Part 3) : 2013 Cl. 11& 12	Voltage : 0 to 980 kV Frequency : 40 kHz to 800 kHz PD Calibrator range: 0 to 1000 pC
7.	Power Transformers up to 2400MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Temperature Rise test	IS 2026 (Part 2) : 2010 Cl. 5 IEC 60076-2 : 2011 Cl. 7 IS 5553 (Part 2) : 1990 Cl. 7.15 IEC 60076 (Part 6) : 2007 Cl. 7.8.14 IEC 60289 : 1988 Cl. 8.15	Current : 0 to 4000 A Voltage : 0 to 200 kV Power : 0 to 5000 kW Temperature : 0 to 150°C Frequency : 50 Hz Current : 0 to 1200 A Voltage : 0 to 980 kV Power : 0 to 5000 kW Temperature : 0 to 150°C Frequency : 50 Hz

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8.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of Zero- Sequence Impedance/ Reactance on three phase transformer/ Reactor	IS 2026 (Part 1) : 2011 Cl. 10.7 IEC 60076-1 : 2011 Cl. 11.6 IS 5553 (Part 2) : 1990 Cl. 7.9 IEC 60076 (Part 6) : 2007 Cl. 7.8.8 IEC 60289 : 1988 Cl. 8.9	Current : 4000 A Voltage : 200 kV Impedance : 0 to 100 % Frequency : 50 Hz
9.	Power Transformers up to 2400MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Lightning Impulse Test	IS 2026 (Part 3) : 2009 Cl. 13 & 14 IEC 60076-3 : 2013 Cl. 13 IS 5553 (Part 2) : 1990 Cl. 7.11.3 IEC 60076 (Part 6) : 2007 Cl. 7.8.10.4 IEC 60076 (Part 3) : 2013 Cl. 13	20 kVp to 3600 kVp

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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
10.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Switching Impulse Test	IS 2026 (Part 3) : 2009 Cl. 15 IEC 60076-3 : 2013 Cl.14 IS 5553 (Part 2) : 1990 Cl. 7.11.4 IEC 60076-6 : 2007 Cl. 7.8.10.6 IEC 60076-3 : 2013 Cl. 14 IEC 60076-4-2002 Cl. 8.3	20 kVp to 3600 kVp
11.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement Of Acoustic Sound Level	IS 2026 (Part 10) : 2009 IEC 60076-10 : 2001 IS 5553 (Part 2) : 1990 Cl. 7.13 IEC 60076-6 : 2007 Cl. 7.8.12 IEC 60289/1988 ; Cl. 8.13	Frequency : 0 to 200 kHz Amplitude : 20 dB to 130 dB
12.	Power Transformers up to 2400 MVA, 765 kV	Load Loss & Impedance measurement of Transformer	IS 2026 (Part 1) : 2011 Cl. 10.4 IEC 60076-1 : 2011 Cl. 11.4	Current : 0 to 4000 A Voltage : 0 to 200 kV Power : 0 to 5000 kW Frequency : 50 Hz

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13.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of Harmonics of current at rated voltage	IS 2026 (Part 1) : 2011 Cl. 10.6 IEC 60076-1 : 2011 Cl. 11.5 IS 5553 (Part 2) : 1990 Cl. 7.8 IEC 60076-6 : 2007 Cl. 7.8.7 IEC 60289 : 1988 Cl.. 8.8	Current : 0 to 4000 A Voltage : 0 to 200 kV Harmonics : 1 to 99 order
14.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of Capacitance & tan delta	IEC 60076-1 : 2011 Cl. 11.1.2.2 IS 5553 (Part 2) : 1990 Cl. 7.4 (h) IEC-60076- : 2011 Cl. 11.1.2.2	Capacitance : 4pF to 50nF Tan delta : 0 to 100%
15.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement Of Power Taken By The Fan & Oil-Pumps	IS 2026 (Part 1) : 2011 Cl. 10.1.3 IEC 60076-1 : 2011 Cl. 11.1.3 IS 5553 (Part 2) : 1990 Cl. 7.4 (f) IEC 60076-6 : 2007 Cl. 7.8.3 IEC 60289 : 1988 Cl.. 8.4 (f)	Voltage : 0 to 600 V Current : 0 to 150 A Power : 0 to 150 kW

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16.	Power Transformers up to 2400 MVA, 765 kV	Tests on on load tap changer	IS 2026 (Part 1) : 2011 Cl. 10.8 IEC 60076-1 : 2011 Cl. 11.7	Qualitative
17.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Bushing CT Test	IS 2705 (Part 4) : 1992 IEC 60044-I	Ratio: (50000 : 1) Max. Output : 0 to 5A max. 120 V Knee Point Voltage : 15 kV max.
18.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	SFRA Test	CBIP manual Pub. No. 295:2006 ; Cl. 7.5 IEC 60076-18 : 2012	Frequency : 10 Hz to 2 MHz
19.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of magnetization Current at low voltage	CBIP manual Pub. No.295:2006 ; Cl. 7.6	Voltage : 0 to 600 V Current : 0 to 100 A Frequency : 50 Hz

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20.	Power Transformers up to 2400 MVA, 765 kV	Magnetic Balance test on three phase transformer/Mutual Reactance on three phase reactor	CBIP manual Pub. No.295:2006 ; Cl. 8.7 IEC 60076-6 : 2007 Cl. No:7.8.9	Voltage : 0 to 600 V Current : 0 to 100 A Frequency : 50 Hz Voltage : 0 to 200 kV Current : 0 to 4000 A Frequency : 50 Hz
21.	Reactor up to 200 MVA, 765 kV	Measurement of Vibration	IS 5553 (Part 2) : 1990 Cl. 7.14 IEC 60076-6 : 2007 Cl. No 7.8.13 IEC 60289 : 1988 Cl. 8.14	Frequency : 8 Hz to 20 kHz Amplitude : 0 to 1000 μ m
22.	Reactor up to 200 MVA, 765 kV	Measurement of Stress & Strain	IEC 60076 (Part 6) : 2007 Cl. 7.8.13 IS 5553 (Part 2) : 1990 Cl. 7.14	Input Voltage : \pm 0.375 V to \pm 5.0 V Strain : \pm 20000 μ m/m
23.	Reactor up to 200 MVA, 765 kV	Measurement of Reactance	IS 5553 (Part 2) : 1990 Cl. 7.6 IEC 60076-6 : 2007 Cl. 7.8.9 IEC 60289 : 1988 Cl. 8.6	Voltage : 0 to 1200 kV Current : 0 to 2000 A Frequency : 50 Hz

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24.	Reactor up to 200 MVar, 765 kV	Measurement of Losses	IS 5553 (Part 2) : 1990 Cl. 7.7 IEC 60076-6 Cl. No: 7.8.6 IEC 60289 : 1988 Cl. 8.7	Voltage : 0 to 1200 kV Current : 0 to 2000 A Power : 0 to 5000 kW Frequency : 50 Hz
25.	Reactor up to 200 MVar, 765 kV	Measurement of Magnetization Characteristic	IS 5553 (Part 2) : 1990 Cl. 7.12 IEC 60076-6 Cl. No 7.8.5.3/7.8.11 IEC 60289 : 1988 Cl. 8.12	Voltage : 0 to 1200 kV Current : 0 to 2000 A Frequency : 50 Hz
26.	Power Transformers up to 2400 MVA, 765 kV	Measurement of Transfer Surge on LV (tertiary) due to HV lighting Impulse & IV lighting impulse	IS 2026 (Part 3) : 2009 Cl. 13.3.3 IEC 60076-3 : 2013 Annex B	0 to 600 kVp
27.	Power Transformers up to 2400 MVA, 765 kV	Measurement of Transfer Surge on LV (tertiary) due to HV switching Impulse & IV switching impulse	IS 2026 (Part 3) : 2009 Cl. 13.3.3 IEC 60076-3 : 2013 Annex B	0 to 600 kVp

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28.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Core assembly dielectric & Earthing Continuity test (Core-Clamp;Core-Tank & Clamp to tank)	CBIP manual Pub. No.295:2006 ; Cl. 7.1 IEC 60076-1 : 2011 Cl. 11.12	0 to 12 kV AC 0 to 5 kV DC
29.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Insulation of Auxiliary Wiring (AuxW)	CBIP manual Pub. No.295:2006 ; Cl. 7.7.2 IEC 60076-3 : 2013 Cl. 9	0 to 12 kV AC 100 V to 5 kV DC Resistance : 10 kΩ to 10 TΩ
30.	Power Transformers up to 2400 MVA, 765 kV	Measurement of Impedance at low voltage	CBIP manual Pub. No.295:2006 ; Cl. 8.9	Voltage : 0 to 600 V Current : 0 to 100 A Frequency : 50 Hz
31.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Thermo vision Scanning of Transformer/ Reactor	CBIP manual Pub. No.295:2006 ; Cl. 1.5.9	Temperature : - 20 °C to 350 °C

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32.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Oil BDV Test	IS 6792 : 1992 IS 9434 : 1992 IEC 156 : 1995	Voltage : 0 to 100 kV
33.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Dissolved Gas Analysis Test (DGA)	IS 9434 : 1992 IEC 60599 : 2007 IEEE PC57.130	H ₂ >0.0001 % CO>0.0001 % CO ₂ >0.0001 % CH ₄ >0.00001 % C ₂ H ₄ >0.00001 % C ₂ H ₆ >0.00001 % C ₂ H ₂ >0.00001 %
34.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of Di-electric dissipation factor (Tan Delta) of Oil	IS 335 : 1993 IS 6262 : 1971 IEC 60247 : 2004	Tan delta: 4 to 1x10 ⁻⁶
35.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Measurement of Specific Resistance (Resistivity) of Oil	IS 335 : 1993 IS 6103 : 1971 IEC 60247 : 2004	Resistivity : 2.5 MΩm to 100 TΩm

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36.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Interfacial tension (IFT)	IS 6104 : 1971	IFT : 1 to 999 mN/m
37.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Moisture content (%)	IS 13567 : 1992 IEC 60814 : 1997	0.0003 % to 20 %
38.	Power Transformers up to 2400 MVA, 765 kV & Reactor up to 200 MVar, 765 kV	Particle Sizing & counts	ISO 4406 : 1999	Size : 0.5 micron to 400 micron Count : >1 count

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