

1.0 TRANSFORMERS & REACTORS

Clause	Activity	Existing norms of testing periodicity in PSTCL	New norms of testing periodicity in PGCIL	New norms of testing periodicity proposed in PSTCL
1.11	Tan Delta measurement of bushing	4 Years, for reactors/transformers less than 220 KV voltage level 2 years, for reactors/transformers more than 220 KV voltage level	2 Years, for reactors/transformers of voltage level of 100 KV or above with any RIP bushing 1 Year, for reactors/transformers of voltage level of 100 KV or above with any OIP bushing	2 Years, for reactors/transformers of voltage level of 100 KV or above with any RIP bushing 1 Year, for reactors/transformers of voltage level of 100 KV or above with any OIP bushing For 66 KV class Power Transformers it will be after 2Yearly 2 Yearly
1.32	Core insulation test	4 Yearly	2 Yearly	2 Yearly

- *Tan δ* Measurement for Bushings of Power Transformers will be after every six months for first two years in following cases-
 - a failed/defective bushing has been replaced with a spare bushing lying in store for more than 5 years & less than 10 years
 - an old Power Transformer has been installed at a new site by construction team
- *Tan δ* Measurement for Bushings of Power Transformers will be after every three months for one year in following case-
 - a failed/defective bushing has been replaced with a spare bushing lying in store for more than 10 years

2.0 CIRCUIT BREAKERS

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms of testing proposed in PSTCL
2.1 a	CB operating time*	Yearly for 400 KV CBs 2Yearly for 220 KV CBs	Yearly for Siemens CBs 2Yearly for other make CBs	For 400 KV & 220 KV CBs- Yearly for Siemens CBs

		3 Yearly for 132 KV CBs 4 Yearly for 66 KV CBs	(#PGCIL has only 765 KV, 400 KV and 220 KV CBs)	2 Yearly for other make CBs For 66 KV & 132 KV CBs it will be 3 YEARLY
2.1c	Static Contact Resistance*	Yearly for 400 KV CBs 2 Yearly for 220 KV CBs 3 Yearly for 132 KV CBs 4 Yearly for 66 KV CBs	2 Y for more than 10 years old CBs Y for less than 10 years old CBs (#PGCIL has only 765 KV, 400 KV and 220 KV CBs)	For 400 KV & 220 KV CBs- 2 Yearly for more than 10 years old CBs Yearly for less than 10 years old CBs 3 Yearly, for 66 KV & 132 KV CBs
2.1d	Dynamic Characteristics (400 KV CBs)	2 Yearly	2 Yearly for less than 10 years old CBs 4 Yearly for more than 10 years old CBs	2 Yearly for less than 10 years old CBs 4 Yearly for more than 10 years old CBs
2.2b	Capacitance & Tan Delta measurement of grading capacitors	4 Yearly	2 Yearly	2 Yearly
#	Overhauling of CB mechanism	SOS	10 Yearly for Pneumatic type 5 Yearly for Hydraulic type	10 Yearly for Pneumatic type 5 Yearly for Hydraulic type For others types- SOS

* First time charging/PCT will be in scope of Protection team but routine testing will be in scope of P&M.
 # New clause to be added as per PGCIL practice
 3.0 CURRENT TRANSFORMERS

Clause	Activity	Existing norms of testing periodicity in PSTCL	New norms of testing periodicity in PGCIL	New norms testing periodicity proposed in PSTCL
3.1 b	Measurement of Tan Delta & capacitance	Yearly- CTs of transformers with capacity 50 MVA & above 2 Yearly - CTs of transformers with capacity below 50 MVA 4 Yearly - Other CTs	2 Yearly- for SF ₆ CTs Yearly- for oil filled CTs	2Y - for SF ₆ CTs Y - for oil filled CTs
3.1 g	Thermo-vision scanning	Yearly	3 Months	3 Months

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4.0 CVTs

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms of testing proposed in PSTCL
4.2a	Measurement of Tan Delta & capacitance	4 Years	SOS	SOS
4.2 d	Thermo-vision scanning	Yearly	3 Months	3 Months

10.2 Line protection relays (DPRs)

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms proposed for testing in PSTCL
10.2.1	Testing of distance protection relays	2 Yearly	3 Yearly	3 Yearly

* New Clause to be added- Carrier Protection Schemes to be tested in case of unwanted operations or trippings resulting in Grid Code Violation – SOS (To facilitate reporting to NRPC/NRLDC minutes of meeting of testing to be recorded at site between T&C, CO&C and PO&S teams between officials not below the rank of AEE/AEs.

#Apart from this CO&C teams will routinely visit all sub-station once every three months and check counter operations, alarms on protection coupler cabinets and intimate to T&C cell (comm.) and ASE/P&OS for immediate action. Monthly progress reports to be submitted to T&C cell (comm.) and ASE/P&OS by respective Sr XENS/CO&C.

10.6 Reactor Protection Relays

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms of testing proposed in PSTCL
10.6 a, 10.6d, 10.6e	Back up impedance relay Reactor Differential Protection REF Protection	Yearly	3Yearly – for Numerical Relays Yearly- for Non-Numerical	3Yearly – for Numerical Relays Yearly- for Non-Numerical

10.7 Transformer protection

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms of testing proposed in PSTCL
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10.7 a, 10.7b, 10.7e, 10.7f	Back up impedance relay Over-current & E/F relays Differential Protection REF Protection	Yearly- 400 KV & above voltage level S/Ss Half Yearly- upto 220 KV voltage level S/Ss	3 Yearly – for Numerical Relays Yearly- for Non-Numerical (# PGCIL deals with only 220 KV and above stations only)	For 220 KV & 400 KV elements- 3 Yearly – for Numerical Relays Yearly- for Non-Numerical Upto 132 KV elements- Half Yearly (Due to high trippings)
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10.8 LBB Protection & 10.10 Bus Bar Protection Relay

Clause	Activity	Existing norms of testing in PSTCL	New norms of testing in PGCIL	New norms proposed for testing in PSTCL
10.8	LBB Protection	Yearly- 400 KV & above S/Ss HY- upto 220 KV S/Ss	5 yearly	5 Yearly
10.10	Bus Bar Protection relay	2 Yearly	5 Yearly	5 Yearly

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Acceptable/Permissible Limits of Test Results for operation switchyard Equipment (ANNEXURE-B)

A. Acceptable/Permissible Limits of Transformers/Reactors

Clause	Equipment/Test Data	PSTCL Permissible Limits (Existing)	New PGCLL Permissible Limits & Proposed PSTCL Permissible Limits																	
1.	Capacitance for Bushings Main Capacitance (C1)	Within -5% to +10% of the variation from previous test result	At the time of first charging Within $\pm 5\%$ of previous testresult	<p align="center">During routing testing</p> <p>Deviation w.r.t pre-commissioning value</p> <table border="1"> <tr> <td>RIP</td> <td>OIP</td> </tr> <tr> <td>420 kV</td> <td>2.6%</td> <td>1.7%</td> </tr> <tr> <td>245KV</td> <td>4.2%</td> <td>2.7%</td> </tr> <tr> <td>Other Rating</td> <td>5%</td> <td>5%</td> </tr> </table> <p>HV & IV & LV Bushings: OIP*: Less than 0.0067 RIP/RIS: Less than 0.0075 Rate of Rise: 0.001 from previous value</p> <p>Neutral Bushings Less than 0.010 (OIP/RIP) *In case of OIP bushings, relative decrease to 0.8 times or less of pre-commissioning value also indicates requirement for replacement.</p>	RIP	OIP	420 kV	2.6%	1.7%	245KV	4.2%	2.7%	Other Rating	5%	5%					
RIP	OIP																			
420 kV	2.6%	1.7%																		
245KV	4.2%	2.7%																		
Other Rating	5%	5%																		
2.	Tan-Delta for Bushings at 20°C	Less Than 0.007	Less than 0.004 (OIP) Less than 0.005 (RIP/RIS)	Less than 0.007																
4	Tan-Delta for winding at 20°C	Less Than 0.007 at 20°C	Less than 0.005	Less than 0.007																
4 a (New)	Tan Delta for Bushing in variable frequency mode	New clause	<p align="center"><u>17 Hz</u></p> OIP: Less than 0.005 RIP: Less than 0.006 <p align="center"><u>391 Hz</u></p> OIP: Less than 0.005 RIP: Less than 0.006	<p align="center"><u>17 Hz</u></p> OIP: Less than 0.005 RIP: Less than 0.006 <p align="center"><u>391 Hz</u></p> OIP: Less than 0.005 RIP: Less than 0.006																
11	Polarization Index (Ratio of IR at 10 minutes	<table border="1"> <tr> <td>PI Value</td> <td>Insulation condition</td> </tr> <tr> <td>Less than 1</td> <td>Dangerous</td> </tr> <tr> <td>1.0 to 1.1</td> <td>Poor</td> </tr> </table>	PI Value	Insulation condition	Less than 1	Dangerous	1.0 to 1.1	Poor	<table border="1"> <tr> <td>Polarization Index</td> <td>Insulation condition</td> </tr> <tr> <td>Less than 1</td> <td>Dangerous</td> </tr> <tr> <td>1.0 to 1.1</td> <td>Poor</td> </tr> </table>	Polarization Index	Insulation condition	Less than 1	Dangerous	1.0 to 1.1	Poor	<table border="1"> <tr> <td>Insulation condition</td> <td>Dangerous</td> </tr> <tr> <td></td> <td>Poor</td> </tr> </table>	Insulation condition	Dangerous		Poor
PI Value	Insulation condition																			
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	to 1 minute)	1.1 to 1.25	Questionable	1.1 to 1.25	Questionable
		1.25 to 2	Fair	1.25 to 2	Fair
		2.0-4.0	Good	Above 2.0	Good
		Above 4.0	Excellent		
13	Transformer/ Reactor Neutral resistance Value	Less than 1 ohm		With grid: below 01 ohm Without Grid: below 10 ohms	With grid: below 01 ohm Without Grid: below 10 ohms
16	SFRA Test (20 Hz to 2 MHz)	Newly Added for 100 MVA & Above transformers		In general, changes of +/- 3 dB (or more) in following frequency range may indicate following faults: During 1 st charging or SOS testing	
17	Degree of Polymerization (DP)	Newly Added residual life assessment test		Frequency Range	Probable Fault
				5Hz to 2 KHz	Shorted turns, open circuit, residual magnetism, or core movement
				50Hz to 20KHz	Bulk movement of windings relative to each other
				500Hz to 2 MHz	Deformation with in a winding
				25Hz to 10MHz	Problems with winding leads and/or test lead placement
				New insulation	1,000 DP to 1,400 DP
				60% to 66% life remaining	500 DP
				30% life remaining	300 DP
				0 life remaining	200 DP

Acceptable/Permissible Limits for Circuit Breakers

SN	Equipment/Test Data	PSTCL Permissible Limits (Existing)	New PGCL Permissible Limits & Proposed PSTCL Permissible Limits																		
1.	Dew Point of SF ₆ Gas	- 45 deg C at atmospheric pressure	-36 deg C at atmospheric pressure (at time of Commissioning) -30 deg C at atmospheric pressure (routine O&M) -28 deg C at atmospheric pressure (Critical condition)																		
10.	PIR Operating Time	5 ms (min) at rated pressure or as per OEM	8 ms																		
11.	Travel of operating Rod of 400 kV CB (mm)	<table border="1"> <tr> <td>CGL</td> <td>Siemens</td> <td>ABB</td> </tr> <tr> <td>140</td> <td>150</td> <td>200</td> </tr> </table>	CGL	Siemens	ABB	140	150	200	<table border="1"> <tr> <td>CGL</td> <td>Siemens</td> <td>ABB</td> <td>Alstom</td> </tr> <tr> <td>120 mm (Spring)</td> <td>150 mm</td> <td>75 deg (LTB)</td> <td>180mm (New addition)</td> </tr> <tr> <td>137-141 mm</td> <td>198-202 mm</td> <td></td> <td></td> </tr> </table>	CGL	Siemens	ABB	Alstom	120 mm (Spring)	150 mm	75 deg (LTB)	180mm (New addition)	137-141 mm	198-202 mm		
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137-141 mm	198-202 mm																				

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12.	Capacitance of Grading Capacitor	Within $\pm 5\%$ of rated value				(Pneumatic)	(E.I.F)
13.	Contact Resistance (in Micro-ohms)	400 kV	220 kV	132 kV	66 kV	No Change	
		75 per break	100	120	150		
54. (new clause)	Controlled Switching Device	Newly Added				Transformers	
					Inrush Current	500A (max)	
					*Pre-arcing time	2.0-3.0 ms (Depending on make/type of CB)	
					*Arcing time	1.5-2.0ms (Depending on make/type of CB)	
					*Pre-arcing time	2.0-3.0ms (Depending on make/type of CB)	
					*Arcing time	6.0-8.0ms (Depending on make/type of CB)	
					*Pre-Arcing & Arcing time are for reference only. Same to be decided based on manufacturer guidelines.		

Acceptable/Permissible Limits for Current Transformers

S.N	Equipment/Test Data	PSTCL Permissible Limits (Existing)	New PGCL Permissible Limits & Proposed PSTCL Permissible Limits
19.	Tan-Delta value during PCT	0.007 (Max)	0.005 (Max.)
	Rate of rise of Tan Delta	0.001 (max)	No change
22.	CT Ratio Errors		
	a) Protection Core	a) $\pm 3\%$	a) As per Technical Specification
	b) Metering Core	b) $\pm 1\%$	b) As per Technical Specification

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		Acceptable/Permissible Limits for Capacitive Voltage/Potential Transformers			
SN	Equipment/Test Data	PSTCL Permissible Limits (Existing)		New PGCL Permissible Limits & Proposed PSTCL Permissible Limits	
25.	Tan-Delta value during pre-commissioning	0.007 (Max)		0.007(Critical) [to be monitored after every six months] 0.01 (to be replaced)	
26.	Change in Capacitance from PCT value	Meas. Value	Meas. Freq.	±5% (Tolerance), beyond this value will require replacement	
		Upto ±2%	3 Yearly		
		±2% to ±3%	Yearly		
		Above ±6%	Replacement		
29.	Drift in secondary Voltage (to be measured by 0.2/0.5 class Multimeter (M means Monthly))	Drift in sec. Voltage		Drift in sec. Voltage	
		Upto ±0.5V	Healthy	Upto ±0.5V	Healthy
		+0.5V to +0.8 V	Monitoring	+0.5V to +0.8 V	Monitoring
		±0.8V to ±2.0 V	Alarm	+0.8V to +1.2 V	Close Monitoring
		<-0.4V & > +2.0 V	Replacement	+1.2 V to +2.0V	Close Monitoring
				Above+ 2.0 V	Alarming
				-0.8V to -4.0 V	Close Monitoring
				Less than -0.4 V	Alarming
					Replacement

		Acceptable/Permissible Limits for Isolators/Batteries/Surge Arrestors			
SN	Equipment/Test Data	PSTCL Permissible Limits (Existing)		New PGCL Permissible Limits & Proposed PSTCL Permissible Limits	
37.	Batteries	Upto 150µA (Gap less)		Normal	
		> 150µA (Gapless)	Alarm	IF IR value < 1000 Mohm	
		150-300µA beyond 350µA (Gapless)	Remove from service	Remove from service	
35.	Surge Arrestors- For LAs in service	Beyond 500µA (Gapped type)		Remove from service	
		Replacement as per testing per ODTL		Normal, however value should be within (+) 20 Micro-Amp of previous value. In case of violation, LA to be monitored on monthly basis. IR test to be to be carried out in next opportunity of S/D	
		Upto 150µA		150-300µA	
		Beyond 350µA		To be tested for insulation test & if value found less than 1000 M-ohm, LA to be removed from service	
				Remove from service	

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