

Light & Power Transformers, Panel, ATO								
Component Classification Categories								
Criticality	I	X					Nuclear Switchyards	
	II		X				DC, SS, TDC, TSS locations that serve O'Hare & Midway Airports	
	III			X			Locations exclusive of Criticality I, DCs, and ≤34kV ESS locations	
	IV				X		DC locations	
	V					X	≤34kV ESS locations	
Duty Cycle	Heavy Load	N/A	N/A	N/A	N/A	N/A		
	Normal load	N/A	N/A	N/A	N/A	N/A		
Service Condition	In Service	X	X	X	X	X		
	Spare	N/A	N/A	N/A	N/A	N/A		
Condition Monitoring Tasks		Task Frequencies				Failure Codes		Comments
Visual Inspection		5W	5W	10W	3M	6M	1b, 3a-f, 5a, 5e	
Thermography		1Y	1Y	1Y	1Y	4Y	1a, 2a-b, 4a-c, 5c	
Time Directed Tasks		Task Frequencies				Failure Codes		Comments
Functional Test (except Telemand)		5W	5W	10W	3M	6M	5d	Where test feature available
Functional Test (Telemand)		1Y	1Y	1Y	1Y	1Y	5d	For ComEd Nuclear Switchyards this is limited to the Telemand ATO in the switchyard building at LaSalle and Dresden. This only includes the transfer switches that feed the AC power to the 345kV relay control house.
Failure Finding		Task Frequencies				Failure Codes		Comments
Check Heaters		5W	5W	10W	3M	6M	5b	
Condition Directed Tasks		Task Frequencies				Failure Codes		Comments
None		N/A	N/A	N/A	N/A	N/A		

Light and Power Transformer Failure Modes

FAILURE MODE	FAILURE CAUSES	MAINTENANCE TASKS
1. Failed to Provide Adequate Cooling 1. Failed to Provide Adequate Cooling	1a. Clogged Corroded Cooler/Radiator 1b. Loss of Oil	Thermography Visual Inspection
2. Fails to Transform Voltage/Current 2. Fails to Transform Voltage/Current	2a. Winding High Resistance 2b. Winding Insulation Failure	Thermography Thermography
3. Fails to Maintain Boundary Integrity 3. Fails to Maintain Boundary Integrity	3a. Gasket Failure 3b. Weld Failure 3c. Tank Corrosion 3d. Loose Connections 3e. Valve Leakage 3f. Tank Over Pressurization	Visual Inspection Visual Inspection Visual Inspection Visual Inspection Visual Inspection Visual Inspection
4. Fails to Provide Adequate Insulation Level 4. Fails to Provide Adequate Insulation Level 4. Fails to Provide Adequate Insulation Level	4a. Loss of Oil 4b. Winding Insulation Failure 4c. Bushing Failure	Thermography Thermography Thermography
5. Fails to Provide Adequate Voltage Level 5. Fails to Provide Adequate Voltage Level	5a. Insulation Failure 5b. Insulation Failure 5c. Lose Connections 5d. Fails to Throwover 5d. Fails to Throwover 5e. Animal Intrusion	Visual Inspection Check Heaters Thermography Functional Test (except Telemant) Functional Test (Telemant) Visual Inspection

Light and Power Maintenance Tasks

TASK	DEFINITION
Check Heaters	Visual / physical verification that heaters, if installed, are operational.
Functional Test (except Telemant)	Use test feature to operate the throw-over to provide it works. Verify local and remote alarms.
Functional Test (Telemant)	Operate the throw-over to prove it works. Verify local and remote alarms. For ComEd Nuclear Switchyards this is limited to the Telemant ATO in the switchyard building at LaSalle and Dresden. This only includes the transfer switches that feed the AC power to the 345kV relay control house.
Thermography	Perform infrared inspection of electrical equipment and power path components to identify any hot spots that may exist either in the contacts, connections or within control cabinets.
Visual Inspection	<p>Visual assessment of the condition of the equipment. Items to check include:</p> <ul style="list-style-type: none"> -- Check oil levels on transformers -- Check cabinet door for degradation of the door seal and for proper operation of the door latch. Check accessible interior components, wiring terminals and fuse holders for rust or corrosion. -- Ensure alarm cutouts are in proper configuration -- Check for signs of loose of work parts in the transfer switch cabinet

Light and Power Transformer Basis

Light & Power Transformer, Panel and ATO Template Summary

The Preventive Maintenance program is documented via maintenance templates. Templates have been developed that address transmission, substation, and distribution equipment that is owned and maintained by Exelon Utilities. Each template documents the program tasks, frequencies, failure modes, and maintenance basis for the associated equipment. Tasks and associated frequencies are designed to address known failure modes of the equipment covered by the template. In general, the tasks included in the maintenance templates are the result of good industry practices, industry experience, and manufacturer recommendations.

References:

Internal reports and operating experience
OEM Maintenance Manuals and Interviews
EPRI 106857 Preventive Maintenance (PM) Basis Documents (PM Basis)
IEEE C57.152-2013 "IEEE Guide for Diagnostic Field Testing of Fluid-filled Power Transformers, Regulators and Reactors"

Boundary Definition

The boundary of a substation type, light & power transformer, panel and ATO (for auxiliary power purposes) is defined from bushing terminal to bushing terminal. This document excludes in-line 12kV/34kV ATOs.

Failure Experiences

Failures are subject to ACE/RCI investigation. Findings/recommended corrective actions are incorporated into the template as required.

Vendor Recommendations

OEM manuals were referenced and interviews conducted during the development of this template.

Disposition of Vendor Recommendations

Recommendations were incorporated into the template as appropriate based on operating experience.

Basis For Template Tasks

Light and Power Transformer Basis

Check Cabinet Heaters: Verifying proper operation of cabinet heaters decreases possibility of corrosion especially on components of the control circuit and operating mechanism.

Functional Test (except Telemant): EPRI 106857 identifies functional testing of control circuits to verify proper operation of the auxiliary systems.

Functional Test (Telemant): EPRI 106857 identifies functional testing of control circuits to verify proper operation of the auxiliary systems.

Thermography: IEEE C57.152 identifies thermography as a primary tool for detection of connection issues, bushing issues, and issues with the cooling systems.

Visual Inspection: This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions.

LIGHT AND POWER TRANSFORMER TEMPLATE DEVELOPMENT HISTORY

Revision 0		Date 06/17/2005
Writer	George Leinhauser (Strategic Programs)	
Reviewer(s)	1/28/05 Template Challenge Session Attendees	
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	To document the maintenance program tasks, frequencies, failure modes, and maintenance basis	
Revision 1		Date 11/10/2006
Writer	Chris Stefanski (Strategic Programs)	
Reviewer(s)		
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	Task and periodicity review / update. General cleanup.	
Revision 2		Date 11/30/2010
Writer	Chris Stefanski	
Reviewer(s)	Ken Wendt (Mgr. Material Condition), Drew Reindel (Mgr. T&S Engineering)	
Approver(s)	Bill Fluhler , Bill Gannon, Nitin Patel, Jim Crane, Bill Sullivan	
Reason Written	Added note to ensure template changes are communicated to affected work groups.	
Revision 3		Date 04/29/2011
Writer	Chris Stefanski (Material Condition)	
Reviewer(s)	Ken Wendt, Drew Reindel, Jim Crane	
Approver(s)	Bill Fluhler (ComEd) , Bill Sullivan (PECO)	
Reason Written	Modified criticality definitions and incorporated 10-week, 3-month and 6-month inspection task frequencies	
Revision EU 0		Date 12/14/2012
Writer	Chris Stefanski (Material Condition)	
Reviewer(s)	Ken Wendt, Drew Reindel	
Approver(s)	Bill Fluhler (ComEd) , J. Coffman (PECO), Chris Lotz (UFAM BGE)	
Reason Written	Changed document number and document template to align with Exelon Utilities Management Model. Corrected frequency of Thermography from 1 Y to 4Y at ESS locations ≤ 34 kV	

LIGHT AND POWER TRANSFORMER TEMPLATE DEVELOPMENT HISTORY

Revision EU 1		Date 06/12/2014
Writer	Steven Scalcucci (Material Condition)	
Reviewer(s)	Ken Wendt, George Leinhauser	
Approver(s)	Michael Moy (ComEd) , J. Coffman (PECO), Chris Lotz (UFAM BGE)	
Reason Written	Modified the Comment field to include clarification on Telemand schemes.	

Revision EU 2		Date 07/21/2014
Writer	Chris Stefanski (Exelon Utilities)	
Reviewer(s)	Ken Wendt, Tom Harrington, George Leinhauser, Ed Carmen	
Approver(s)	Michael Moy (UFAM ComEd) , J. Coffman(UFAM PECO), Cory Summerson (UFAM BGE)	
Reason Written	Changed applicability note regarding BGE maintenance programs. Changed criticality definition to include applicability to BGE - Calvert Cliffs nuclear switchyard.	

Revision CE 0		Date 02/18/2015
Writer	Chris Stefanski (Exelon Utilities)	
Reviewer(s)	Ken Wendt	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	Created to document the ComEd maintenance program tasks, frequencies, failure modes, and maintenance basis.	

Revision CE 1		Date 02/12/2018
Writer	Hugo Castaneda (Material Condition)	
Reviewer(s)	Dale Player (Mgr Material Condition), Doug Mason (T&S Equipment Stds)	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	3 year review with minor format changes, IEEE reference update and boundary clarification. No content change.	