

<b>Submersible Transformers</b>				
Component Classification Categories				
Criticality	I	X		Network Transformers
	II		X	Customer Vault Applications
Duty Cycle	Heavy Load	N/A	N/A	
	Normal Load	N/A	N/A	
Service Condition	In Service	N/A	N/A	
	Spare	N/A	N/A	
<b>Condition Monitoring Tasks</b>				
	<b>Task Frequencies</b>		<b>Failure Codes</b>	<b>Comments</b>
Visual Inspection (external)	1Y	3Y	1a, 2a-e, 3b, 3f	
Ammeter Reading	1Y	N/A	1a	Ammeter installed on Spot Networks
<b>Failure Finding Tasks</b>				
	<b>Task Frequencies</b>		<b>Failure Codes</b>	<b>Comments</b>
Dielectric Test	5Y	N/A	3a	Where applicable
<b>Time Directed Tasks</b>				
	<b>Task Frequencies</b>		<b>Failure Codes</b>	<b>Comments</b>
None	N/A	N/A		
<b>Condition Directed Tasks</b>				
	<b>Task Frequencies</b>		<b>Failure Codes</b>	<b>Comments</b>
None	N/A	N/A		

### **FAILURE MODES**

- 1. Fails to Provide Adequate Cooling
- 1. Fails to Provide Adequate Cooling
  
- 2. Fails to Maintain Boundary/Structural Integrity
  
- 3. Fails to Provide Adequate Insulation Level

### **FAILURE CAUSES**

- 1a. Overload
- 1b. Debris in Manhole
  
- 2a. Gasket Failure
- 2b. Weld Failure
- 2c. Tank Corrosion
- 2d. Loose Connections
- 2e. Tank Over Pressurization
- 2f. Locking Mechanism Failure
  
- 3a. Insulation Oil Breakdown
- 3a. Insulation Oil Breakdown
- 3b. Loss of Oil
- 3c. Solid Insulation Failure
- 3d. Winding Insulation Failure
- 3e. Bushing Failure
- 3f. Vegetation/Animal Intrusion

### **MAINTENANCE TASKS**

- Ammeter Reading
- Visual Inspection
  
- Visual Inspection
- Visual Inspection
- Visual Inspection
- Visual Inspection
- Visual Inspection
- Security Check
  
- Thermography
- Dielectric Test
- Visual Inspection
- Thermography
- Thermography
- Thermography
- Visual Inspection

<b>TASK</b>	<b>DEFINITION</b>
Ammeter Reading	Obtain peak amperage readings at Spot Network transformer to monitor load.
Dielectric Test	Analyze dielectric strength of oil via sample to ensure oil quality of 3 phase Network Transformer main tank and HV compartment.
Security Check	Ensure locking mechanism integrity.
Thermography	Infrared inspection of electrical equipment and power path components to identify any hot spots that may exist.
Visual Inspection	External visual inspection of equipment and miscellaneous hardware that identifies broken / degraded components. Items inspected are documented via procedures posted to the Management Model under control element Conduct of Maintenance.

## **Distribution Transformer 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

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### **Boundary Definition**

The boundary is defined as the transformer.

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### **Failure Experiences**

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

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### **Vendor Recommendations**

N/A

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### **Disposition of Vendor Recommendations**

N/A

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### **Basis For Template Tasks**

**Ammeter Reading:** This task determines the loads associated with Spot Network Transformers.

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**Dielectric Test:** This task determines the dielectric strength of the 3 phase Network Transformer main tank and HV compartment oil to ensure the oil insulation quality is adequate.

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**Security Check:** Ensure locking mechanism integrity.

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**Thermography:** A primary tool for detection of hot spots and connection issues.

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**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.

<b>Revision 0 (CE)</b>		<b>Date 12/29/2006</b>
Writer	Larry Griess (Strategic Programs)	
Reviewer(s)		
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	To document the maintenance program tasks, frequencies, failure modes, and maintenance basis	

<b>Revision 1 (CE)</b>		<b>Date 11/30/2010</b>
Writer	Chris Stefanski	
Reviewer(s)	Ken Wendt (Mgr. Material Condition)	
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.	

<b>Revision 2 (CE)</b>		<b>Date 06/10/2011</b>
Writer	Rodolfo Patriarca	
Reviewer(s)	Pete Yan, Keith Frost, Ken Wendt	
Approver(s)	Bill Fluhler	
Reason Written	To document the maintenance program frequencies.	

<b>Revision 0 (CE)</b>		<b>Date 03/02/2011</b>
Writer(s)	Daniel Kurtz	
Reviewer(s)	Tom Rafferty (BGE), Marty Rave (ComEd), Giuseppe Termini (PECO)	
Approver(s)	Cory Summerson (UFAM BGE), Mike Moy (UFAM ComEd) , J. Coffman (UFAM PECO)	
Reason Written	EU PM Template Alignment (BGE, ComEd, PECO); Separate templates created for Padmount, Submersible, and Pole Top transformers	