

Reclosers							
Component Classification Categories							
Criticality	I	X					Three Phase Oil Insulated
	II		X				Three Phase Non Oil Insulated
	III			X			Single Phase Oil Insulated
	IV				X		Single Phase Non Oil Insulated
Duty Cycle	Heavy Load	N/A	N/A	N/A	N/A		
	Normal Load	N/A	N/A	N/A	N/A		
Service Condition	In Service	N/A	N/A	N/A	N/A		
	Spare	N/A	N/A	N/A	N/A		
Condition Monitoring Tasks		Task Frequencies				Failure Codes	Comments
Visual Inspection		10Y	10Y	10Y	10Y	4a-b, 5a-b, 6a-d, 7a-d, 8e-f, 9a-b	
Inspect Control Cabinet		10Y	10Y	N/A	N/A	8c, 8g	
Check Oil Level		10Y	N/A	N/A	N/A	6b	
Time Directed		Task Frequencies				Failure Codes	Comments
Battery Replacement		10Y	10Y	N/A	N/A	1d, 2d, 8b	
Failure Finding Tasks		Task Frequencies				Failure Codes	Comments
Functional Operations Check		10Y	10Y	N/A	N/A	1a-c, 1e-i, 2a-c, 2e-2i, 3a-g, 8a, 8c-g, 9a-d	
Condition Directed Tasks		Task Frequencies				Failure Codes	Comments
None		N/A	N/A	N/A	N/A		

Sectionalizers				
Component Classification Categories				
Criticality	I	X		Three phase
Duty Cycle	Heavy Load	N/A		
	Normal Load	N/A		
Service Condition	In Service	N/A		
	Spare	N/A		
Condition Monitoring Tasks		Task Frequencies	Failure Codes	Comments
Visual Inspection		10Y	4a-b, 5a-b, 6a-d, 7a-d, 8e-f, 9a-b	
Inspect Control Cabinet		10Y	8c, 8g	
Check Oil Level		10Y	6b	
Time Directed		Task Frequencies	Failure Codes	Comments
Battery Replacement		10Y	1d, 2d, 8b	Or as needed
Failure Finding Tasks		Task Frequencies	Failure Codes	Comments
Functional Operations Check		10Y	1a-c, 1e-i, 2a-c, 2e-2i, 8a, 8c-g, 9a-d	
Condition Directed Tasks		Task Frequencies	Failure Codes	Comments
None		N/A		

FAILURE MODE	FAILURE CAUSES	MAINTENANCE TASKS
<ul style="list-style-type: none"> 1. Fails to Close 	<ul style="list-style-type: none"> 1a. Close coil Failure 1b. Control Circuit Failure 1c. RTU Failure 1d. Battery Failure 1e. Lack of Lubrication 1f. Interrupter Failure 1g. Mechanical/Linkage Failure 1h. Stored Energy Failure 1i. PT/CT/Relay Failure 	<ul style="list-style-type: none"> Functional Operations Check Functional Operations Check Functional Operations Check Battery Replacement Functional Operations Check
<ul style="list-style-type: none"> 2. Fails to Open 	<ul style="list-style-type: none"> 2a. Open Coil Failure 2b. Control Circuit Failure 2c. RTU Failure 2d. Battery Failure 2e. Lack of Lubrication 2f. Interrupter Failure 2g. Mechanical/Linkage Failure 2h. Stored Energy Failure 2i. PT/CT/Relay Failure 	<ul style="list-style-type: none"> Functional Operations Check Functional Operations Check Functional Operations Check Battery Replacement Functional Operations Check
<ul style="list-style-type: none"> 3. Fails to Interrupt 	<ul style="list-style-type: none"> 3a. Open Coil Failure 3b. Control Circuit Failure 3c. Lack of Lubrication 3d. Interrupter Failure 3e. Mechanical/Linkage Failure 3f. Stored Energy Failure 3g. PT/CT/Relay Failure 	<ul style="list-style-type: none"> Functional Operations Check
<ul style="list-style-type: none"> 4. Fails to Provide Conduction Path 4. Fails to Provide Conduction Path 	<ul style="list-style-type: none"> 4a. Wire Connection Failure 4b. Isolating Switch Failure 	<ul style="list-style-type: none"> Visual Inspection Visual Inspection
<ul style="list-style-type: none"> 5. Fails to Provide Bypass Conduction Path 5. Fails to Provide Bypass Conduction Path 	<ul style="list-style-type: none"> 5a. Wire Connection Failure 5b. Bypass Switch Failure 	<ul style="list-style-type: none"> Visual Inspection Visual Inspection
<ul style="list-style-type: none"> 6. Fails to Provide Adequate Insulation Level 	<ul style="list-style-type: none"> 6a. Internal/External Contamination 6b. Loss of Oil 6b. Loss of Oil 6c. Bushing Failure 6d. Surge Arrester Failure 6d. Surge Arrester Failure 	<ul style="list-style-type: none"> Visual Inspection Visual Inspection Oil Level Check Visual Inspection Visual Inspection Radio Interference check

FAILURE MODE

FAILURE CAUSES

MAINTENANCE TASKS

- 7. Fails to Maintain Boundary Integrity

- 7a. Gasket Failure
- 7b. Weld Failure
- 7c. Tank Corrosion
- 7d. Loose Connections

- Visual Inspection
- Visual Inspection
- Visual Inspection
- Visual Inspection

- 8. Control Fails to Operate Properly

- 8a. RTU Failure
- 8b. Battery Failure/UPS
- 8c. Wiring Failure
- 8c. Wiring Failure
- 8d. Communication Failure
- 8e. PT/CT/Relay Failure
- 8e. PT/CT/Relay Failure
- 8f. Auxiliary Component Failure
- 8f. Auxiliary Component Failure
- 8g. Blown Fuse
- 8g. Blown Fuse

- Functional Operations Check
- Battery Replacement
- Inspect Control Cabinet
- Functional Operations Check
- Functional Operations Check
- Visual Inspection
- Functional Operations Check
- Visual Inspection
- Functional Operations Check
- Inspect Control Cabinet
- Functional Operations Check

- 9. Fails to Provide Indication

- 9a. Mechanical Indicator Failure
- 9a. Mechanical Indicator Failure
- 9b. Local Bulb Failure
- 9b. Local Bulb Failure
- 9c. RTU Failure
- 9d. Communication Failure

- Visual Inspection
- Functional Operations Check
- Visual Inspection
- Functional Operations Check
- Functional Operations Check
- Functional Operations Check

TASK	DEFINITION
Battery Replacement	Replace the Control & RTU batteries.
Check Oil Level	Check oil level where applicable.
Functional Operations Check	Closing and open the device and check the position indication. Also checking the Hot Line Tag Function.
Inspect Control Cabinet	Check interior of control cabinet for accumulation of dust and dirt; clean as necessary. Check door gasket for effective seal, repair or replace as required. Check for broken or loose wiring terminals and blown fuses. Visually inspect circuit boards for burnt or damaged components. Verify control box heater is on.
Record Operations Counter	Record operations counter locally or remotely. This may include both a mechanical counter and/or a digital counter integral to the controls.
Visual Inspection	Visually inspect external components. Check for broken or cracked bushings, blown arresters, oil leaks, check for paint scratches and other mechanical damage; touch up to inhibit corrosion.

Recloser and Sectionalizer 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:

ANSI C37.60, "Requirements for Automatic Circuit Reclosers for Alternating-Current Systems"

ANSI C37.61, "Guide for the Application, Operation and Maintenance of Automatic Circuit Reclosers"

Cooper Power Systems Service Information S280-42-1, "Type NOVA Three-Phase, Microprocessor - Controlled Recloser Installation and Operation Instructions"

Cooper Power Systems Service Information S280-40-6, "Types VWE, VWVE27, VWVE38X Electronically Controlled Recloser Maintenance Instructions"

Cooper Power Systems Service Information S280-45-5, "Type VSA-12, VSA-16 and VSA-20/800 Three-Phase Recloser Maintenance Instructions"

Cooper Power Systems Service Information S280-15-1, "Type L Recloser Maintenance Instructions"

Cooper Power Systems Service Information S280-90-6, "Electronic Control Battery Testing, Charging, and Replacement Instructions"

Cooper Power Systems Service Information S280-15-7, "Type V4L, V4E Single-Phase Maintenance Instructions"

ABB Power T&D Company I.B. 38-750-1 Issue D, "Type VR-3S 15-38kV 560/800A Instructions for Vacuum Recloser"

Boundary Definition

The boundary for the purpose of this document is defined to include the tank, bushings, interrupters, insulating oil (where applicable), operating mechanism, and integral controls.

Excluded from this template are the associated equipment that interfaces with the device controller such as source transformers and SCADA controls.

Failure Experiences

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

Vendor Recommendations

Vendor documentation was reviewed in the development of this template.

Disposition of Vendor Recommendations

N/A

Basis For Template Tasks

Battery Replacement: Battery life is limited. Replacement of batteries on a time directed basis will ensure that the battery will be operational.

Check Oil Level: Indicator of possible leaks.

Functional Operations Check: ensure that device will operate.

Inspect Control Cabinet: Ensure that the cabinet is free of debris and the door seal is an effective barrier against moisture intrusion. Also provides for a check for damaged components that need repair

Operations Counter Reading: Readings trending may be used for future program modification.

Radio Interference Check: Used to detect defective lightning arresters caused by failure of the insulating gap or semiconducting material inside the arrester.

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.

Revision 0 (R3005)		Date 12/29/2006
Writer	Nick Aludo (Strategic Programs)	
Reviewer(s)		
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	To document the maintenance program tasks, frequencies, failure modes, and basis	

Revision 1 (R3005)		Date 11/30/2010
Writer	Chuck Priebe	
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.	

Revision 2 (R3005)		Date 06/10/2011
Writer	Rodolfo Patriarca	
Reviewer(s)	Pete Yan, John Yancey, Ron Riley, Keith Frost, Ken Wendt, Chris Stefanski	
Approver(s)	Bill Fluhler	
Reason Written	To add three phase non oil Reclosers and Automatic Sectionalizers. To document the maintenance program tasks, frequencies, failure modes and basis.	

Revision 3 (R3005)		Date 07/29/2013
Writer	Kenneth Wendt	
Reviewer(s)	Peter Yan, Daniel Brotzman	
Approver(s)	Bill Fluhler (UFAM)	
Reason Written	Remove the Operations Counter Reading Task from Single Phase Reclosers, update the Visual Inspection Frequency on Single Phase Reclosers to 4 Years.	

Revision 4 (R3005)		Date 12/3/2013
Writer	Kenneth Wendt	
Reviewer(s)	Peter Yan, Daniel Brotzman	
Approver(s)	Michael Moy (UFAM)	
Reason Written	Change Pad Mounted Recloser Security Check to 8Y	

Revision 0		Date 07/14/2015
Writer	Dave Darji, Engineer/Intern, Distribution Standards	
Reviewer(s)	Michael Keller, Mgr Distribution Standards(PECO); Charles Beckner Sr Engineering Tech Specialist(BGE); John Yancey, Mgr Distribution Automation(ComEd); Wasif Qazi, Engineer(PECO)	
UFAM Approver (s)	Michael Moy (ComEd UFAM), Preventative Maintenance, Director Asset Performance;	
Reason Written	EU Alignment on Minimum inspection cycle	

Revision 1		Date 07/30/2018
Writer	Jimi Conway (ComEd)	
Reviewer(s)	Pat Arns (ComEd); Keith Frost (ComEd); Jeff Gates (ComEd)	
UFAM Approver (s)	Michael Moy (ComEd UFAM)	
Reason Written	Three-yr cycle review. Revised text for task descriptions for Functional Operations Check and Record Operations counter. FOC text revised to include remote operation & checking to be satisfactory for satisfying task requirements. ROC text revised to remove trending requirement in the task description and to include remote collection of data as satisfactory for satisfying task requirements.	