STANDALONE* SUBSTATION AUTOMATION SCHEMES
MAINTENANCE TEMPLATE

**Not maintained under other Maintenance Templates*

AM-CE-P034-R1042
Rev. 5

Revisions to this document shall be communicated in accordance with program document AM-EU-P034 to ensure alignment between Maintenance Templates and field work procedures.

Standalone Substation Automation Schemes					
Component Classification Categories					
Criticality	I	X			ComEd SEL-Based and Electromechanical DC Interlock Schemes
	II		X		ComEd Substation Distribution Automation Schemes
	III	N/A	N/A		All Other Locations
Duty Cycle	Heavy Load	N/A	N/A		
	Normal Load	N/A	N/A		
Service Condition	In Service	X	X		
	Spare	N/A	N/A		

Automation Equipment	**Task Frequencies***		**Failure Codes**	**Comments**
Functionally verify automation equipment settings are as specified	**4Y**	**6Y**	**1i**	
Non-Microprocessor Automation Equipment Only: **Test and, if necessary calibrate automation equipment**	**4Y**	**6Y**	**1g-h**	
Microprocessor Automation Equipment Only: **Verify operation of automation equipment inputs and outputs essential to proper functioning of the Standalone Substation Automation Scheme**	**4Y**	**6Y**	**1a-e**	
Microprocessor Automation Equipment Only: **Verify acceptable measurement of power system input values**	**4Y**	**6Y**	**2a-b**	
Automation Circuitry	**Task Frequencies***		**Failure Codes**	**Comments**
Verify all paths of the automation circuits essential for proper operation of the Standalone Substation Automation Scheme inclusive of all auxiliary relays, automation circuit interlocks, and power system equipment operations	**4Y**	**6Y**	**1a-f, 1j-k**	
Verify automation circuit path for all inputs that initiate the Standalone Substation Automation Scheme	**4Y**	**6Y**	**1a-f, 1j-k**	
Alarming Paths and Monitoring	**Task Frequencies***		**Failure Codes**	**Comments**
Verify operation and reset of Standalone Substation Automation Scheme internal alarms and power supply fail alarms from the point of origin to the dispatcher or SCADA system logging database	**4Y**	**6Y**	**2c**	

***All intervals are performed with a 25% Grace Period unless otherwise noted.**

STANDALONE* SUBSTATION AUTOMATION SCHEMES
FAILURE MODES

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FAILURE MODES	FAILURE CAUSES	MAINTENANCE TASKS
1. Scheme fails to operate as designed	1a. Loose wiring terminations	Tighten connections
1. Scheme fails to operate as designed	1b. Damaged control relay contact	Repair/replace relay
1. Scheme fails to operate as designed	1c. Incorrect wiring	Troubleshoot circuit per schematic drawing to determine correct wiring
1. Scheme fails to operate as designed	1d. Wiring damaged	Troubleshoot to locate damaged wiring then replace
1. Scheme fails to operate as designed	1e. Relay armature or contacts damaged	Replace control relay
1. Scheme fails to operate as designed	1f. C/S or MOD auxiliary contacts out of alignment	Realign contacts
1. Scheme fails to operate as designed	1g. Timing relay time delay out of tolerance	Recalibrate to setting order or replace if necessary
1. Scheme fails to operate as designed	1h. 27 UV relay setpoint out of tolerance	Recalibrate to setting order or replace if necessary
1. Scheme fails to operate as designed	1i. Relays set incorrectly/not as designed	Investigate and reset relays per design
1. Scheme fails to operate as designed	1j. DC control power absent	Investigate cause and restore DC control power
1. Scheme fails to operate as designed	1k. Blocking diode failure	Replace diode
2. Relays fail to monitor power system	2a. Power system voltages not interrupted correctly by relay	Measure & verify accurate power system input interpretation by relay
2. Relays fail to monitor power system	2b. Power system currents not interrupted correctly by relay	Measure & verify accurate power system input interpretation by relay
2. Relays fail to monitor power system	2c. Relay hardware	Verify relay alarms

STANDALONE* SUBSTATION AUTOMATION SCHEMES
TASK DEFINITIONS

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TASK	DEFINITION
Functionally verify automation equipment settings are as specified	Verifies Substation Automation Scheme performs as specified at the conclusion of maintenance activities. Intent of the test is to identify instances where settings may have "drifted" since the prior maintenance or to restore changes that were made as part of the testing process.
Microprocessor Automation Equipment Only: Verify acceptable measurement of power system input values	Verifies integrity of relay's AC input circuitry. Each utilized power system input is checked by either applying test signals or using actual power system signals to verify protective relay receives the power system inputs per design.
Microprocessor Automation Equipment Only: Verify operation of automation equipment inputs and outputs essential to proper functioning of the Standalone Substation Automation Scheme	Verifies integrity of relay's DC input and output circuitry. Each utilized input and output is checked to verify it operates per design. Multiple contacts in series are checked to verify that operation of one contact does not initiate an input.
Non-Microprocessor Automation Equipment Only: Test and, if necessary calibrate automation equipment	Verifies if the relay is out of setting tolerance since the last routine and by how much.
Verify all paths of the automation circuits essential for proper operation of the Standalone Substation Automation Scheme inclusive of all auxiliary relays and automation circuit interlocks	Verifies the internal portions of the Substation Automation Scheme circuits. This includes verifying proper operation of open and closed contacts as well as proper operation of any blocking diodes. If an essential Substation Automation Scheme circuit fails to operate as designed, it would impact automated substation reconfiguration and/or re-energization where applicable.
Verify all paths of the Standalone Substation Automation Scheme that operate power system equipment inclusive of all auxiliary relays through the trip and close coil(s) of the circuit breaker or other interrupting devices	Verifies the external operating aspects of a Substation Automation Scheme. If a Substation Automation Scheme fails to operate (open or close) power system device(s), it would impact automated substation reconfiguration and/or re-energization where applicable.
Verify automation circuit path for all inputs that initiate the Standalone Substation Automation Scheme	Verifies external triggers to initiate or provide input into the Substation Automation Scheme. Failure to properly initiate or provide input to a Substation Automation Scheme will impact automated substation reconfiguration and/or re-energization where applicable.
Verify operation and reset of Standalone Substation Automation Scheme internal alarms and power supply fail alarms from the point of origin to the dispatcher or SCADA system logging database	Verifies integrity of relay alarm contact(s) and circuitry by simulating alarm conditions and verifying alarm was received in SCADA. An undetected relay fail alarm or relay major and/or minor alarm could impact substation configuration and/or re-energization where applicable.

STANDALONE* SUBSTATION AUTOMATION SCHEMES
MAINTENANCE BASIS

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Standalone Substation Automation Scheme Maintenance 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:
None

Boundary Definitions
The boundary of the Standalone Substation Automation Schemes includes:
- DC Interlock Schemes as deployed in ComEd Transmission/Distribution Centers (TDC) and certain Transmission Substations (TSS).
- 12kV Bus-Tie Auto-closing Schemes as deployed in ComEd.
- Intellisub substation automation/reconfiguration schemes

Excluded from this treatment are:
- Protection Systems covered under PRC-005-6
- Protective Relay testing including calibration, setting verification, control circuit testing, and alarm testing.
- The normal RA5 operation of transformer 79 reclosing relays.
- The 138kV transformer bushing potential devices that provide source voltage for the 27 under voltage relays
- The proper maintenance of 138kV C/S and MODs.
- Station Aux Power ATOs

Failure Experiences
Typical failures have been caused by out of tolerance timing relays, mis-alignment of MOD or C/S aux contacts and failure of 79 reclosing relays.

Vendor Recommendations
n/a

Disposition of Vendor Recommendations
n/a

Basis for Template Tasks
Maintenance tasks and intervals are generally similar to BES maintenance as recommended by the NERC PRC-005-6 Reliability Standard.

STANDALONE* SUBSTATION AUTOMATION SCHEMES
DEVELOPMENT HISTORY

**Not maintained under other Maintenance Templates*

	Revision 0	**Date 01/26/2007**
Writer	John Juna (Real Time Analysis)	
Reviewer(s)		
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	To document the maintenance program tasks, frequencies, failure modes, and maintenance basis	

	Revision 1	**Date 11/30/2010**
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.	

	Revision 2	**Date 04/29/2011**
Writer	Chris Stefanski (Material Condition)	
Reviewer(s)	Ken Wendt, Drew Reindel, Jim Crane	
Approver(s)	Bill Fluhler (ComEd)	
Reason Written	Modified criticality definitions and incorporated 10-week inspection task frequency	

	Revision 3	**Date 03/19/2014**
Writer	Suneetha Parupalli (Material Condition)	
Reviewer(s)	Ken Wendt (Mgr. Material Condition), Jay Anderson (Sr. Engineer, Relay and Protection)	
Approver(s)	Mike Moy (ComEd)	
Reason Written	3 year review, reformat document, No content change	

	Revision 4	**Date 06/12/2015**
Writer	Kevin Swiat (ComEd)	
Reviewer(s)	Dan Wasilewski (ComEd), Ken Wendt (ComEd)	
Approver(s)	Michael Moy (ComEd)	
Reason Written	Consolidated tasks to align with other protective system maintenance templates, updated task definitions, updated failure modes.	

STANDALONE* SUBSTATION AUTOMATION SCHEMES
DEVELOPMENT HISTORY

**Not maintained under other Maintenance Templates*

	Revision 5	**Date 03/16/2018**
Writer	Kevin Swiat (ComEd)	
Reviewer(s)	Martin Copello (ComEd), Amjad Farooqi (ComEd)	
Approver(s)	Michael Moy (ComEd)	
Reason Written	Updated all references from PRC-005-2 to PRC-005-6; Added headers to all tabs; Completed 3 year review.	