

DISTRIBUTION PROTECTION SYSTEM MAINTENANCE - PROTECTIVE RELAYS, VOLTAGE AND CURRENT SENSING DEVICES, AND CONTROL CIRCUITRY
MAINTENANCE TEMPLATE

AM-CE-P034-R1032
Rev. 1

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.

Distribution Protection System Maintenance - Protective Relays, Voltage & Current Sensing Devices & Control Circuitry (Includes Non-BES Lines, Busses, Breakers < 69kV, Non-BES Transformers w/High-Side Winding ≤ 230kV, and Non-BES Capacitor Banks)						
Component Classification Categories						
Criticality	I		X		All Distribution Protective Relay Systems not identified as Criticality II	
	II			X	All Non-BES 138kV and 69kV High-Side Transformer Protective Relay Systems	
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		
Protective Relays						
			Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify Protective Relay settings are as specified			6Y	4Y	1a,2a,3a,4a,5a,6a	
Non-Microprocessor Relays Only: Test and, if necessary calibrate the relay(s)			6Y	4Y	1b,2b,3b,4b,5b,6b	
Microprocessor Relays Only: Verify operation of the relay inputs and outputs essential to proper functioning of the Protection System			6Y	4Y	1b,2b,3b,4b,5b,6b	
Microprocessor Relays Only: Verify acceptable measurement of power system input values			6Y	4Y	1b,2b,3b,4b,5b,6b	
Control Circuitry						
			Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify that each trip coil is able to operate the circuit breaker, interrupting device, or mitigating device			6Y	4Y	1b,2b,3b,4b,5b,6b	
Verify electrical operation of electromechanical lockout devices			6Y	4Y	1b,2b,3b,4b,5b,6b	
Verify all paths of the trip and close circuits inclusive of all auxiliary relays through the trip & close coil(s) of the circuit breaker or other interrupting devices			6Y	4Y	1b,2b,3b,4b,5b,6b	Includes control circuitry associated with Sudden Pressure Relaying.
Alarming Paths and Monitoring						
			Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify operation and reset of Protective Relay internal alarms and power supply fail alarms from the point of origin to the dispatcher or SCADA system logging database and local annunciation where applicable			6Y	4Y	1b,2b,3b,4b,5b,6b	
Sudden Pressure Relays						
			Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify the pressure or flow sensing mechanism is operable			6Y	4Y	1b,2b,3b,4b,5b,6b	Includes main tank and LTC, where Sudden Pressure relay operates trip circuit

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

DISTRIBUTION PROTECTION SYSTEM MAINTENANCE - COMMUNICATIONS
MAINTENANCE TEMPLATE

AM-CE-P034-R1032
Rev. 1

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Distribution Protection System Maintenance - Communications (Includes Non-BES Lines, Busses, Breakers < 69kV, Non-BES Transformers w/High-Side Windings ≤ 230kV, and Non-BES Capacitor Banks)					
Component Classification Categories					
Criticality	I	X			All Distribution Protective Relay Systems not identified as Criticality II
	II		X		All Non-BES 138kV and 69kV High-Side Transformer Protective Relay Systems
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		
Communications Systems		Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify Communication System is functional		6Y	4Y	1b,2b,3b-c,4b-c,5b-c,6b-c	
Alarming Paths and Monitoring		Task Frequencies*	Task Frequencies*	Failure Codes	Comments
Verify operation and reset of loss of function alarms from the point of origin to the dispatcher or SCADA system logging database		6Y	4Y	1b,2b,3b,4b,5b,6b	

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

**DISTRIBUTION PROTECTION SYSTEM MAINTENANCE
TASK DEFINITIONS**

TASK	DEFINITION
Microprocessor Relays 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 Relays Only: Verify operation of the relay inputs and outputs essential to proper functioning of the Protection System	Verifies integrity of relay's DC input and output circuitry. Each utilized control 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 Relays Only: Test and, if necessary calibrate the relay(s)	Verifies if the relay is out of setting tolerance since the last routine and by how much. Relay testing should include performance checks, calibration, and routine maintenance as suggested in manufacturer guidelines.
Verify the pressure or flow sensing mechanism is operable	Ensure sudden pressure relay will operate when called upon to do so.
Verify all paths of the trip and close circuits inclusive of all auxiliary relays through the trip & close coil(s) of the circuit breaker or other interrupting devices	Verifies all paths of the trip and close circuits inclusive of all auxiliary relays through the trip & close coil(s) of the circuit breakers or other interrupting devices including control circuitry associated with Sudden Pressure Relaying. If an external trip or a trip coil fails to operate power system interrupting device(s), it could impact fault isolation, relay coordination, or Breaker Failure operations. If a close operation fails to operate it could prevent automatic load restoration or station reconfiguration.
Verify Communication System is functional	Assures communication equipment is functionally performing as dictated by the interface equipment. Assures that the output contacts are operational.
Verify electrical operation of electromechanical lockout devices	Verifies electrical operation of electromechanical lockout device. If lockout device fails to operate, it could impact fault isolation, relay coordination, or Breaker Failure operations.
Verify operation and reset of loss of function 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 cause a relay misoperation as well as impact relay coordination, reclosing, or Breaker Failure operations.
Verify operation and reset of Protective Relay 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 cause a relay misoperation as well as impact relay coordination, reclosing, or Breaker Failure operations.
Verify Protective Relay settings are as specified	Verifies that the protective relay settings be as specified at the conclusion of maintenance activities, whether those settings may have "drifted" since the prior maintenance or whether changes were made as part of the testing process.
Verify that each trip coil is able to operate the circuit breaker, interrupting device, or mitigating device	Verify that each trip coil is able to operate the circuit breaker, interrupting device, or mitigating device. If an external trip or a trip coil fails to operate power system interrupting device(s), it could impact fault isolation, relay coordination, or Breaker Failure operations.

DISTRIBUTION PROTECTION SYSTEM MAINTENANCE MAINTENANCE BASIS

Distribution Protection System Maintenance Template Summary

The Preventive Maintenance program is documented via maintenance templates. Templates have been developed to 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:

PRC-005-6 Protection System Maintenance Standard (Tasks and Intervals adapted as needed for this document to apply to distribution systems and equipment)

Boundary Definitions

The boundary of a distribution protection systems for the purpose of this document is defined to include the protective relay, potential and current transformer secondary wiring, panel wiring and cabling to interrupting devices for lines, busses and breakers < 69kV and transformers with a high-side winding ≤ 230kV (which includes main tank or LTC sudden pressure relays that operate a trip circuit).

Excluded from the scope of this document are: The power equipment such as transformers, circuit breakers, transmission lines etc; any and all equipment considered to be part of the Bulk Electric System as defined in the NERC Glossary of Terms or any and all equipment otherwise applicable to PRC-005 or subsequent reliability standards.

Failure Experiences

n/a

Vendor Recommendations

Depending on the vendor and the type of relay, maintenance requirements will vary. Electromechanical relays normally require extensive maintenance such as checking pickup and dropout points, checking impedance characteristics, timers etc. Microprocessor relays primarily require checking the input quantities, such as voltage and current.

Disposition of Vendor Recommendations

n/a

Basis for Template Tasks

n/a

**DISTRIBUTION PROTECTION SYSTEM MAINTENANCE
DEVELOPMENT HISTORY**

Revision 0		Date 8/31/2015
Writer	Kevin Swiat (ComEd)	
Reviewer(s)	Dan Wasilewski (ComEd), Ken Wendt (ComEd)	
Approver(s)	Michael Moy (ComEd)	
Reason Written	Addresses AR#000553459-23 to align Co-Gen feeders and lines on a 6Y maintenance interval. This document supercedes and combines previous ComEd Distribution Protection System Maintenance documents AM-ED-P034-R1034 Communications, Distribution Lines below 69 kV; AM-CE-P034-R1071 Distribution Transformer Relaying; and AM-CE-P034-R1072 Relaying, Distribution Breaker.	

Revision 1		Date 8/3/2018
Writer	Kevin Swiat (Material Condition)	
Reviewer(s)	Martin Copello (Protection & Control Engineering)	
Approver(s)	Michael Moy (ComEd)	
Reason Written	Updated reference from previous reliability standard to PRC-005-6 on Maintenance Basis tab; added page numbers and document number to all tabs; Revised task for Sudden Pressure Relay testing to align with accepted industry standard wording (reference PRC-005-6 Table 5); Added comment for control circuitry testing to clarify that task also includes control circuitry associated with Sudden Pressure Relaying; Completed 3-year review	