

Distribution Network Protector					
Component Classification Categories					
Criticality	I	X			O'Hare/Midway Airport and 34kV Protectors
	II		X		Two-transformer Spot Networks
	III			X	All other locations
Duty Cycle	Heavy Load	N/A	N/A	N/A	
	Normal Load	N/A	N/A	N/A	
Service Condition	In Service	N/A	N/A	N/A	
	Spare	N/A	N/A	N/A	
Condition Monitoring Tasks					
	Task Frequencies			Failure Codes	Comments
Operations Counter Reading	1Y	1Y	1Y	1d	
Visual Inspection	1Y	1Y	1Y	1a, 1e, 2b, 4a	
Failure Finding Tasks					
	Task Frequencies			Failure Codes	Comments
None	N/A	N/A	N/A		
Time Directed Tasks					
	Task Frequencies			Failure Codes	Comments
Maintain Contacts and Arc Chutes	1Y	5Y	5Y	1f-g, 3a	
Circuit Breaker Inspection	1Y	5Y	5Y	1e, 1h, 2a, 2d	
Clean and Lubricate	1Y	5Y	5Y	1b	
Relay and Mechanism Frame Inspection	1Y	5Y	5Y	1c, 1e	
Enclosure Inspection	1Y	5Y	5Y	5a-c	
Enclosure Leak Test	1Y	1Y	2.5Y	5a-c	Submersible network protector enclosures in sidewalk vaults and other outdoor applications
Relay Calibration	1Y	1Y	2.5Y	1a, 2b-c	
Condition Directed Tasks					
	Task Frequencies			Failure Codes	Comments
None	N/A	N/A	N/A		

FAILURE MODES

- 1. Fails to Operate

- 2. Fails to Control

3. Fails to Provide Conduction Path

4. Fails to Provide Adequate Insulation Level

- 5. Fails to Maintain Boundary Integrity

FAILURE CAUSES

- 1a. Control Circuit Failure
- 1a. Control Circuit Failure
- 1b. Degraded Lubrication
- 1c. Mechanical/Linkage Failure
- 1d. Stored Energy Failure
- 1e. Loose Electrical Connections
- 1e. Loose Electrical Connections
- 1e. Loose Electrical Connections
- 1f. Contact Welding
- 1g. Improper Alignment of Contacts
- 1h. Motor/Control Failure

- 2a. Internal Connection Failure
- 2b. Control Circuit Failure
- 2b. Control Circuit Failure
- 2c. Relay Failure/Out of Adjustment
- 2d. Component Failure

3a. High Contacts Resistance

4a. External Contamination

- 5a. Frame Weld Failure
- 5a. Frame Weld Failure
- 5b. Frame Corrosion
- 5b. Frame Corrosion
- 5c. Loose Connections
- 5c. Loose Connections

MAINTENANCE TASKS

- Visual Inspection
- Relay Calibration
- Clean and Lubricate
- Relay and Mechanism Frame Inspection
- Operation Counter Reading
- Circuit Breaker Inspection
- Relay and Mechanism Frame Inspection
- Visual Inspection
- Maintain Contacts and Arc Chutes
- Maintain Contacts and Arc Chutes
- Circuit Breaker Inspection

- Circuit Breaker Inspection
- Visual Inspection
- Relay Calibration
- Relay Calibration
- Circuit Breaker Inspection

Maintain Contacts and Arc Chutes

Visual Inspection

- Enclosure Inspection
- Enclosure Leak Test
- Enclosure Inspection
- Enclosure Leak Test
- Enclosure Inspection
- Enclosure Leak Test

TASK	DEFINITION
Circuit Breaker Inspection	<p>Scope includes:</p> <ul style="list-style-type: none"> -- Visual inspection of all springs, nuts, pins and screws to make sure they are in their proper places and that none are broken. -- Check Dashpots for proper functionality. -- Check terminal block and electrical connections are for tightness and integrity. -- Visual inspection of barriers, the shunt trip mechanism, motor assembly, spark plug, target assembly and the operating handle and interlock. -- Inspection of the bushing, fuse mounts and secondary fuse links.
Clean and Lubricate	<p>Minimum scope is lubrication of OEM specified mechanism and linkage wear points. All bearing should be checked for free movement.</p>
Enclosure Inspection	<p>Inspect fuses, links and terminals for evidence of overheating. Visually inspect enclosure parts for corrosion and check all barriers for damage.</p>
Enclosure Leak Test	<p>Enclosure is pressurized with dry air and must hold 4 psi for 5 minutes. 'Snoop' is used to locate leaks.</p>
Maintain Contacts and Arc Chutes	<p>Check main contacts to make sure they are clean, perfectly smooth and make good contact. Verify that the arcing contacts make before the secondary contacts, and that the secondary contacts make before the main contacts when the protector operates. Check all arc chutes to see that the path between the splitter plates is open. Check all current carrying paths for evidence of overheating</p>
Operations Counter Reading	<p>Record the number of mechanical operations since the last inspection.</p>

Relay and Mechanism Frame
Inspection

Check clearance between the roller mechanism and the bearing plate on the moving contact assembly. The motor control relay and the cutoff switch are checked to be making good contact. Includes checking and cleaning all relay contacts (mechanical relays only). A visual inspection of all electrical connections, springs, nuts, pins, and screws is performed.

Relay Calibration

Verify settings such as master reverse trip, master reclosing volts, phasing reclosing, watt-var, BN relay, and time delay relay.

Visual Inspection

Scope includes:

- Check insulators, bushings, limiters and all lug connections for contamination and tracking.
- Verify nomenclature and labeling are correct and legible.
- Verify protector operating handle is on Auto.
- Verify integrity of low side fuse links and check for arcing or tracking.
- Verify all test switches, relays, controls, control cords, grounds and power feeds are normal.

Network Protector Template Summary

The Preventive Maintenance program is documented via Performance Centered Maintenance (PCM) templates. Templates have been developed that address all transmission, substation, and distribution equipment that is owned, and / or, maintained by EED. 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 PCM templates are the result of good industry practices, industry experience, and manufacturer recommendations.

References:

Type CM-22 Network Protectors 800-3500 Amperes - Instruction Bulletin 35-500-1E
Type CMD Network Protectors 1875-3000 Amperes - Instruction Bulletin 35-552-G
OP-ED-142008 Transformer Network Center Feeder Manipulations Overview

Boundary Definition

The boundary of a Network Protector includes:

- Circuit breaker including linkage and contacts
- Relay and mechanism frame
- Control equipment
- Motor and fuses

Excluded from this treatment are: Network transformers, foundations, ammeters, the Vault structure and any SCADA controls

Failure Experience

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

Vendor Recommendations

N/A

Disposition of Vendor Recommendations

N/A

Basis For Template Tasks

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

Clean and Lubricate: The mechanism of a circuit breaker is composed of multiple bearing and sliding surfaces that require periodic re-lubrication due to minimum movement of parts during breaker operation.

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

Enclosure Leak Test: Proves enclosure's air tight seal.

Maintain Contacts and Arc Chutes: Ensure that breaker will operate when required.

Operations Counter Reading: Monitor the number of operations.

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

Relay Calibration: Ensure proper operation when required.

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		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 maintenance basis	

Revision 1		Date 06/30/2010
Writer	Chris Stefanski (Material Condition)	
Reviewer(s)	Bill Fluhler, Keith Frost, Pete Tyschenko, John Basten	
Approver(s)	Ron Donovan, Brian Graham, Michelle Blaise	
Reason Written	Revised frequency and defined application and scope of enclosure leak test.	

Revision 2		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 3		Date 01/27/2014
Writer	Suneetha Parupalli, Sr Engineer, Material Condition	
Reviewer(s)	Ken Wendt (Mgr. Material Condition)	
Approver(s)	Mike Moy (UFAM)	
Reason Written	3 year review, reformat document, No content change	

Revision 4		Date 12/29/2014
Writer	Daniel Kurtz	
Reviewer(s)	James Bezila (PECO), Ed Smykowski (ComEd), Ed Lake (BGE), Beth Pittaway (BGE)	
Approver(s)	Cory Summerson (UFAM BGE), Mike Moy (UFAM ComEd), J. Coffman (UFAM PECO)	
Reason Written	EU PM Template Alignment (BGE, ComEd, PECO)	

Revision 5		Date 12/29/2017
Writer	Jimi Conway, Sr Engineer, Material Condition (ComEd)	
Reviewer(s)	Keith Frost (ComEd), Ed Smykowski (ComEd)	
Approver(s)	Mike Moy (UFAM ComEd)	
Reason Written	3 year review. 2-yr cycles corrected to 2.5-yr cycle to align with current process.	