PPL companies

AOP

Electric APPROVED OPERATING POLICIES

Subject
Inspection Of Systems

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Policy
INSPECTION, MAINTENANCE, AND LOAD MONITORING REQUIREMENTS FOR DOWNTOWN LOUISVILLE SECONDARY NETWORK

SECTION 1 –PURPOSE

1.1 This policy describes operating, maintenance, and inspection requirements for the LG&E-KU low voltage secondary network system in downtown Louisville, Kentucky. Inspection, maintenance, and load monitoring is intended to ensure public safety, minimize the potential for public property damage resulting from delivery system failures, provide safe access and working conditions for operating and maintenance personnel, and to provide reliable electric service.

SECTION 2 – SCOPE

2.1 This policy addresses routine facility inspection, preventive maintenance, and load monitoring requirements applicable to the LG&E-KU low voltage secondary network facilities and equipment. Generally, LG&E-KU facilities will include vaults, manholes, transformers, network protectors, cables, ventilating equipment, and associated hardware.

SECTION 3 – REFERENCES

3.1 Kentucky Administrative Regulations, Title 807 KAR 5:006, Section 25, Inspection of Systems.

3.2 Kentucky Occupational Safety and Health Act (KOSHA).

3.3 LG&E-KU Health & Safety Manual, Latest edition.

3.4 EOM&I IS-002, Regulatory Inspection Requirements for the Downtown Louisville Secondary Network.

SECTION 4 –RESPONSIBILITIES

4.1 The Asset Management Electric System Codes and Standards shall have responsibility for the requirements of this Policy. Revisions to this policy shall be reviewed and approved by the Directors of Asset Management and Distribution Operations.

4.2 Auburndale Operations Center shall have responsibility for execution of this policy. Execution of this policy shall include inspecting network vaults and manholes; cleaning and ventilating network vaults; operating trip tests; inspecting, cleaning, and maintaining network protectors; and monitoring network loads.

SECTION 5 –DISCUSSION

5.1 Regulatory Accountability

5.1.1 In accordance with 807 KAR 5:006, Section 25 (4) (b) 3, each utility shall inspect, at intervals not to exceed six months, “underground network transformers and network protectors in vaults located in buildings or under sidewalks, for leaks, condition of case, connections, temperature and overloading”.

Dir. Asset Management	Dir. Distribution Operations	Dir. Distribution Reliability

SECTION 6 – POLICY

6.1 Inspect Network Vaults and Equipment

6.1.1 Visually inspect the vault enclosure and vault structural equipment including, ceilings, walls, and floors; interior doors; entrance hatches, frames, and ladders; drip pans, shields, and drains; ventilating blowers and duct; drains and dry wells; and cable and equipment mounting hardware. Inspect locking provisions and ensure access security.

6.1.2 Visually inspect vault electrical equipment including, network transformers and protectors; cable bus; transformer, protector, and service conductors; conductor connections; fuse boxes; vault lighting and wiring; and load monitoring equipment. Inspect the transformer case for dielectric coolant leaks. Read, record and reset oil temperature gauges and peaking demand load monitoring equipment.

6.1.3 Vault and vault equipment inspections shall be performed semi-annually.

6.2 Inspect Network Manholes and Equipment

6.2.1 Visually inspect manhole and hardware including, ceilings, walls, and floors; entrance throats; manhole ring and cover; duct openings; dry wells; and equipment mounting hardware.

6.2.2 Visually inspect manhole electrical equipment including, primary, secondary, street lighting, and service cables; communication cables; private and foreign utility conductors; electrolysis cables; grounding and bonding wires; primary cable splices and terminations; secondary and service cable splices, junctions, and terminations; grounding and bonding wire connections; and switching equipment.

6.2.3 Network manhole inspections shall be performed bi-annually. Assign manholes to two annual groups. Inspect each group on alternate calendar years.

6.3 Clean Network Vaults

6.3.1 Remove debris from network vaults and associated equipment to minimize vault fire potential, to minimize equipment surface corrosion and rust, to reduce dust type protector cleaning, and to provide a safe and dry workplace.

6.3.2 Dust off network transformers and network protector cases.

6.3.3 Remove and discard debris from catch pans, ventilating grates, drains and dry wells, and vault floors.

6.3.4 Vault cleaning shall be performed semi-annually.

6.4 Inspect Flood Prone Network Vaults

6.4.1 Inspect vault equipment and pump water from vaults during and/or following heavy rains.

6.4.2 Publish and maintain a list of vaults that retain water during heavy rain.

6.5 Ventilate Network Vaults

6.5.1 Operate and maintain forced air ventilation in summer peaking vaults.

a. Turn “on” blowers during Spring, prior to summer load increase.
b. Turn “off” blowers during Fall, following summer load decline.

6.5.2 Clean, lubricate, and winterize blower fans, duct, and vents following summer service.

6.5.3 Publish and maintain a list of vaults that contain ventilating equipment.

6.6 Feeder Trip Test

6.6.1 Network protector trip and close operations shall be tested prior to annual load periods, to verify successful and proper operation.

6.6.2 Test trips shall be performed annually during the Spring season while network loads are at seasonal minimums.

a. Individual circuits may be exempted from a scheduled test trip if all network protectors operated successfully during the 6 month period immediately preceding the scheduled test trip. The test trip record must reflect the date of the successful operation.

6.6.3 Each network circuit shall be tripped open, one circuit at a time. Load Dispatch will “OPEN” and “CLOSE” the circuit breaker to perform the test.

a. Following each circuit interruption, verify that the affected protectors "OPENED" upon loss of circuit voltage. Load Dispatch will note that the circuit potential light goes out if all protectors successfully tripped open.
b. Following circuit restoration, verify that affected network protectors "CLOSED."

6.7 Preventive Maintenance - Inspect, Clean, and Adjust Network Protectors

6.7.1 Inspect, clean, and adjust network protectors (WHILE ENERGIZED) to ensure safe and reliable operation. Refer to detailed, step-by-step instructions for each protector type.

a. Visually inspect condition of enclosures, mounting hardware, and external terminations.
b. Visually inspect condition of internal components, including breaker assembly, fuses, links, barriers, relays, control wiring for evidence of broken, loose, and overheated parts.
c. Clean and dust external covers and internal components.
d. Lubricate and adjust moving parts.
e. Clean and lubricate relay mechanism and contacts.

6.7.2 Dust Cover Type and No Cover Type Protectors

a. Perform routine inspection, cleaning, and adjustments, annually.

6.7.3 Submersible Type Protectors

a. Perform routine inspection, cleaning, and adjustments, annually.

6.8 Field Testing – Network Protector

6.8.1 Perform electrical and mechanical field operating tests on network protectors and relays immediately following a protector mis-operation or protector maintenance work. Mis-operations include failures to trip or close during normal operation or during Feeder Trip Tests, as defined in Section 6.6.

a. Refer to detailed, step-by-step instructions provided by the manufacturer for each protector and relay type.
b. Check electrical and mechanical operation using a network simulation test kit.
c. Re-calibrate or exchange relay.

6.9 Monitor Network Load

6.9.1 Vault Load Peak Demand

a. Monitor totalized peaking summer and winter demands on network transformers and protectors.
b. An AD-6 maximum demand, current type meter and associated current transformers shall be installed in each network vault. The AD-6 meter will be configured to totalize the coincident demand of all transformers in the vault.

c. Read, reset, and record AD-6 meters during the Spring and Fall seasons to capture the maximum demand during the preceding Winter and Summer seasons, respectively.

6.9.2 Vault Load Indicating Tests and Thermal Imaging Tests

a. Monitor phase loads and operating temperature on network vault buss, network protector leads, transformer secondary leads, service leads and street main ties to identify imbalance conditions and poor cable connections.
b. Vault load indicating tests and thermal imaging tests shall be conducted annually during the Summer season.

6.9.3 Secondary and Service Load Indicating Tests

a. Monitor summer season loads on network secondary street mains and services and vault supply main and services to support load flow analysis on the secondary network grid.
b. Monitor secondary street main continuity detect open circuit cables.
c. Summer season load tests shall be conducted bi-annually. Schedule secondary and service load tests on alternating calendar years during June, July, or August.
d. Street main continuity tests shall be conducted and recorded bi-annually during bi-annual regulatory manhole inspections.

6.10 Network Transformer High Voltage Compartment Insulating Compound Test

Cable insulating compounds in high voltage cable terminating compartments shall be dielectric tested to detect the presence of moisture on five year intervals.

6.11 Work Schedules

The activities defined in sections 6.1 through 6.10 above shall be performed coincidentally to optimize technician productivity and to minimize travel time. The requirements of this AOP are sufficient to meet the regulatory inspection requirements as defined in EOM&I-SI-002, "Regulatory Inspection Requirements for Downtown Louisville Secondary Network."

6.12 Network Protector Corrective Maintenance

Network protector corrective maintenance, including repair, rebuild, and decommissioning shall be individually determined by the network engineer and operating team leader using preventive maintenance histories, operating performance, and test trip results.

SECTION 7 - SAFETY

7.1 All applicable provisions of the Company safety manual shall be observed.

7.2 Cleaning and maintenance of network protectors involve working on energized equipment with exposed and unshielded components.

SECTION 8 – ENVIRONMENTAL

8.1 The downtown network system contains several environmentally regulated materials and compounds.

8.1.1 Network protectors manufactured prior to 1990 utilized asbestos-containing materials in arc-extinguishing assemblies, non-metallic structural members, and insulating barrier boards.

8.1.2 Network cable bus conductors and connections manufactured and installed prior to the early -1980's utilize asbestos fire proofing tapes.

8.1.3 Network transformers contain insulating fluids, such as, mineral oil, high fire point mineral oil, silicon fluid, and various cable compounds. Network transformers may contain traces of Polychlorinated Biphenols (PCB).

8.1.4 Paper Insulated Lead Covered (PILC) primary and secondary cables and associated cable splices are insulated with medium and high viscosity oils and petroleum based compounds contained within an overall lead jacket.

8.2 Special measures are required when disturbing and/or disposing asbestos-containing materials. Contact the Environmental Affairs Department prior to handling and disposing of asbestos materials.

8.3 Fluid release from network transformers in network vaults shall be immediately contained and reported promptly to the Transformer Services Department for cleanup.

8.3.1 Transformers labeled as containing PCB fluids or not having a label specifically stating that the fluid is non-PCB, shall be handled as if containing PCB fluids.

8.3.2 Fluid releases and disposal shall be reported to the Environmental Affairs Department.

8.4 Materials containing lead may require special disposal considerations. Contact the Environmental Affairs for disposal recommendations and assistance.

SECTION 9 – TRAINING AND QUALIFICATIONS

9.1 Employees performing cleaning, inspection, testing, and rebuilding must be qualified by training and/or experience.

SECTION 10 –EQUIPMENT

10.1 Network testing equipment and recording instruments

10.1.1 Network protector electrical test kit.
10.1.2 Electronic relay interface devices.
10.1.3 Voltmeter.
10.1.4 Ammeter.
10.1.5 Recording voltmeter.
10.1.6 Recording ammeters.
10.1.7 Thermometer (ambient air).
10.1.8 Thermal imaging camera.

SECTION 11 – RECORD KEEPING

11.1 Vault, manhole, and miscellaneous equipment inspection and maintenance records provided in Sections 6.1 through 6.5 shall be retained by the Auburndale Operations Center for a minimum of five years.

11.2 Network protector trip tests, preventive maintenance, field tests provided in Section 6.6 through 6.8 and primary termination compound dielectric tests provided in Section 6.10 shall be retained by the Auburndale Operations Center for the life of the equipment asset.

11.3 Load monitoring records provided under Section 6.9 shall be retained by Asset Management - System Analysis and Planning group.