

POTOMAC ELECTRIC POWER COMPANY

Transmission and Interconnection Reliability Standards

I. Transmission Reliability Standards

Pepco's bulk transmission system shall be planned and constructed in such a manner that it can be operated so that the more probable contingencies can be sustained with no loss of load. Less-probable contingencies will be examined to determine their effect on system performance.

These standards apply to bulk power transmission facilities including the facilities which have the primary function of giving Pepco a point of interconnection to generation and to the PJM and neighboring transmission systems. These Criteria do not apply to facilities affecting the reliability that supply only to local loads.

Pepco's transmission planning criteria are consistent with the North American Electric Reliability Council (NERC), ReliabilityFirst Corporation (RFC), PJM Interconnections. As a result of restructuring, the Pennsylvania-New Jersey-Maryland Interconnection (PJM), as the Independent System Operator (ISO), is responsible for planning the bulk transmission system, including Pepco's facilities, under the PJM Open Access Transmission Tariff and Schedule 6 to the PJM Operating Agreement.

II. Transmission Criteria

The bulk transmission system shall be developed so that it can be operated at all load levels to meet the following unscheduled contingencies without instability, cascading, or interruption of load. Normally, maintenance is expected to be scheduled so that these criteria are not violated.

- A. The loss of any single generating unit, transmission line, transformer, circuit breaker or bus, in addition to normal scheduled outages including maintenance outages, without exceeding the applicable Emergency Rating of any facility or the applicable voltage criteria. After the outage, the system must be capable of readjustment so that all equipment will be loaded within Normal Ratings.

After occurrence of the outage and the readjustment of the system specified above, the subsequent outage of any remaining generator, line, or transformer without exceeding the applicable Short Time Emergency Rating of any facility. After this outage, the system must be capable of readjustment so that all remaining equipment will be loaded within the applicable Emergency Rating and the voltage criteria will be met for the probable duration of the outage.

- B. The loss of any double-circuit line or the combination of facilities resulting from a line fault and a stuck breaker, in addition to normal scheduled outages including maintenance outages, without exceeding the applicable Short Time Emergency Rating of any facility. After the outage, the system must be capable of readjustment so that all remaining equipment will be loaded within the applicable Emergency Rating and the voltage criteria will be met for the probable duration of the outage.

III. Stability Requirements

The stability of the system shall be maintained without loss of load during and after the following types of contingencies occurring at the most critical location at all load levels.

- A. A three-phase fault with normal clearing time.
- B. A single-phase-to-ground fault with a stuck breaker or other cause for delayed clearing.
- C. The loss of any single facility with no fault.

IV. Voltage and Reactive Requirements

The Transmission System shall have controls capable of maintaining the voltages at levels which will not exceed the limits of the connected equipment and will allow for meeting the voltage criteria specified in {D-III-A} on the Distribution System, during both normal and contingency conditions.

Sufficient reactive compensation with adequate controls will be planned to allow supply of the reactive load and losses requirement in order to maintain acceptable voltage profiles, generally within $\pm 5\%$ of nominal voltage, on the Pepco Transmission System at all load levels during normal conditions and any of the contingencies described in {II} above.

V. Tests by Simulation for the Ability of the Pepco System to Withstand Abnormal Disturbances

It is recognized that it is impossible to anticipate or test for all of the contingencies that can occur on the present or future Pepco system. The system, therefore, will be tested by simulation to determine the effect of various types of abnormal disturbances on system performance, including stability. These tests serve primarily as a means to measure the ability of the system to withstand less probable contingencies, some of which may not be readily apparent. These tests are prescribed not on the basis of a high level of probability, but rather as a practical means to study the system for its ability to withstand disturbances beyond those which can reasonably be expected.

Recognition should be given to the occurrence of similar contingencies in neighboring systems and their effect on the Pepco system.

Examples of less probable contingencies to be studied are:

- A. The sudden loss of the entire generating capability of any station for any reason.
- B. The outage of the most critical transmission line on any one of the interconnected systems as the result of a three-phase fault immediately following (i.e., before adjustment) the tripping of another critical line on the same or an adjacent system.
- C. A single-phase-to-ground fault coupled with the malfunction of a protective device.
- D. The sudden loss of all lines of one voltage emanating from a substation.
- E. The sudden loss of all lines on a single right of way.
- F. The sudden dropping of a large load or a major load center.
- G. The occurrence of a multi-phase fault with delayed clearing.

VI. Relaying and Protective Devices

Independent devices shall be installed to the extent necessary to provide backup for the primary protective devices and components so as to limit equipment damage, to limit the shock to the system and to speed restoration of service. The design of a particular line's relay protective schemes shall recognize the need for an appropriate balance between dependability (assurance that relays will operate when required) and security (protection against relay operation when not required). In cases where the requirements of Sections {II-A} and/or {IV} are not met, additional security against the overtripping of critical facilities may be

considered. Relaying installed shall not restrict the normal or the necessary realizable network transfer capabilities of the system.

VII. Ratings

Generally, ratings are defined as Normal, Emergency, or Short Time Emergency. All ratings are based on PJM rating methods and are provided by either Transmission Engineering and Design or Distribution Engineering and Construction.

A. Normal Operation -- All loads must be within the facility's normal rating.

B. Emergency Operation -- Applicability of emergency ratings is explained in {II}.

1. The Emergency Rating referred to is a generic term for equipment emergency ratings of various durations depending on the type of equipment:

- Underground Pipe-Type cable = 300 hours
- All other underground cable = 36 hours
- All other equipment = 24 hours

2. The Short Time Emergency Rating referred to is a generic term for equipment emergency ratings of various durations depending on the type of equipment:

- Overhead conductors = 10 hrs.
- Transformers = 4 hrs.
- Underground Pipe-Type cables for all 230kV & 115kV & for Feeder 13851 = 300 hrs.

- Underground Pipe-Type cables for all 138kV except Feeder 13851 = 4 hrs.

C. The capacities of existing circuits at 115kV up to 500kV have been determined, generally by using actual construction parameters, and are shown in Appendix II.

D. In planning studies for adding new circuits, the thermal capacities to be used are to be based on the ratings and design voltage-class of the cable or wire size to be installed, taking into account existing and proposed infrastructure installations along the route and the normal operating voltage.

VIII. Associated Items

A. System Standard Frequency

Standard frequency on the Pepco System is 60 hertz.

B. Under-Frequency Load Shedding

Under-frequency relays are installed to provide additional insurance against widespread system disturbances. The electric companies operating under the PJM ISO have agreed to under-frequency load shedding allocations on an equitable basis. The Pepco share is 30% of its system peak load. Approximately 10% of the total load shedding occurs by each of the following frequencies: 59.3 HZ, 58.9 HZ, and 58.5 HZ. Pepco's under-frequency relays are set to pick up at each one-tenth H

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