

**A. Introduction**

1. **Title: Automatic Underfrequency Load Shedding Requirements**
2. **Number: PRC-006-SERC-01**
3. **Purpose: To establish SERC requirements for automatic underfrequency load shedding (UFLS)**
4. **Applicability:**
  - 4.1 **Distribution Provider (that participates in a UFLS scheme)**
  - 4.2 **Transmission Owners**
  - 4.3 **Load Serving Entity (that participates in a UFLS scheme)**
  - 4.4 **Generator Owner**
  - 4.5 **Transmission Planner**
5. **(Proposed) Effective**

**B. Requirements**

- R1** Each Transmission Planner in the SERC footprint shall determine appropriate islands to study as a design basis for UFLS. These islands shall be chosen from system studies, actual system operations, or other islands as deemed appropriate. Islands identified to form a design basis for UFLS shall include at least the following two islands: [*Violation Risk Factor: Medium*]
- R1.1.** A single island that includes all of the SERC footprint to verify that all SERC UFLS schemes meet the performance requirements when acting together.
- R1.2** A single island for each SERC Subregion to verify that all UFLS schemes within the subregion meet the performance requirements when acting together.
- R2** Each Transmission Planner in the SERC footprint shall design an automatic UFLS scheme that meets the following minimum requirements: [*Violation Risk Factor: High*]
- R2.1** Have the capability of shedding at least 30 percent of connected load determined from the forecasted annual peak hour load.
- R2.2** Shed load with a minimum of three frequency set points.
- R2.3** The highest frequency set point with time delay of less than one second shall be no lower than 59.3 Hz and not higher than 59.5 Hz.
- R2.4** The lowest frequency set point shall be no lower than 58.4 Hz
- R2.5** The difference between frequency set points shall be at least 0.2 Hz but no greater than 0.5 Hz.
- R2.6** Time delay (from frequency reaching the set point to the trip signal) shall be at least 6 cycles

**R3** The Transmission Planner shall design its UFLS scheme to meet performance requirements R3.1 through R3.4 for each identified island (if any) in its footprint. The Transmission Planner shall design its UFLS scheme such that when combined with all of the other UFLS schemes in the Region, the composite will meet performance requirements R3.1 through R3.4 for the Region considered as an island. The Transmission Planner shall design its UFLS scheme such that when combined with all of the other UFLS schemes in its Subregion, the composite will meet performance requirements R3.1 through R3.4 for the Subregion considered as an island. [*Violation Risk Factor: High*]

**R3.1** These performance requirements shall be satisfied for underfrequency conditions resulting from an imbalance between load and generation of 25 percent for all design basis islands (generation equals 75% of load).

**R3.1.1** Frequency decline shall be arrested at no less than 58.0 Hz.

**R3.1.2** Frequency shall not remain below 58.5 Hz for greater than 10 seconds, cumulatively, and shall not remain below 59.5 Hz for greater than 30 seconds, cumulatively.

**[Note: the SERC UFLS Standard Drafting Team requested these criteria be changed by NERC]**

**R3.1.3** Frequency overshoot resulting from operation of UFLS relays shall not exceed 61.0 Hz for any duration and shall not exceed 60.5 Hz for greater than 30 seconds, cumulatively. **[Note: the SERC UFLS Standard Drafting Team requested these criteria be changed by NERC]**

**R3.1.4** Bulk Electric System voltage during and following UFLS operations shall be controlled such that the per unit Volts per Hz (V/Hz) will not exceed 1.18 for longer than 2 seconds, cumulatively, and will not exceed 1.10 for longer than 45 seconds, cumulatively. **[Note: the SERC UFLS Standard Drafting Team requested these criteria be changed by NERC]**

**R3.2** Transmission Planners shall verify UFLS schemes are coordinated by performing dynamic simulations that demonstrate that the performance requirements of R3.1 are met.

**R3.2.1** If the aggregation of the Transmission Planners' UFLS schemes for an island or subregion fails to meet all the requirements in R3.1, an individual Transmission Planner in that island or subregion can demonstrate that its UFLS scheme meets the requirements of R3.1 by performing dynamic simulations that apply its UFLS scheme on its individual system or on the entire island or subregion.

- R4** All Transmission Planners within the SERC footprint are responsible for assessing their UFLS schemes by performing dynamic simulations that demonstrate that the performance requirements of R3.1 are met at least once every five years. [*Violation Risk Factor: Medium*]
- R4.1.** The Transmission Planner shall perform a dynamic simulation for any of the following situations:
- new islands are identified
  - material design changes are made to the scheme parameters defined in R2
  - material changes to the boundaries of a specified island are identified
- R4.2** Transmission Planners shall provide the study results to SERC or NERC within 30 calendar days of a request.
- R5** Each Transmission Owner in the SERC footprint shall be responsible for implementing the UFLS scheme developed by the Transmission Planner. The Transmission Owner may coordinate with all Distribution Providers and Load Serving Entities serving the connected load to implement the automatic UFLS scheme. Transmission Owners may participate with other Transmission Owners to implement the UFLS scheme developed by the Transmission Planner responsible for their collective systems. [*Violation Risk Factor: High*]
- R5.1** The Transmission Owner shall own, install, and set UFLS equipment, except those portions of the UFLS scheme implemented by the Distribution Providers and Load Serving Entities.
- R5.2** The Distribution Providers and Load Serving Entities that participate in the UFLS scheme shall own, install, and set the associated UFLS equipment.
- R6** In those cases where a generator must be tripped due to underfrequency such that they do not coordinate with the performance requirements of R3.1.1 and R3.1.2, the Generator Owners shall arrange for load shedding to be installed in addition to that required by the UFLS scheme. [*Violation Risk Factor: Medium*]
- R6.1** This additional load shedding shall be equal to or greater than the generator MW and instituted at the same frequency and time as the generator would be expected to trip.
- R6.2** This additional load shedding shall be located within the same subregion and any islands as the generator. The Transmission Planner identifies islands as part of the development of the UFLS scheme.
- R7** The Generator Owner, Transmission Owner, and any other entity which participates in a UFLS scheme shall provide UFLS data for the SERC

UFLS database. This data shall be provided to the Region at least once every five years or within 30 calendar days of a request by the Region. [Violation Risk Factor: Lower].

**R7.1** Entities that own, install, and set UFLS equipment shall supply the following information, as implemented in the field:

**R7.1.1** Underfrequency trip set points (Hz).

**R7.1.2** Time delay (from initiation to trip signal) associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the signal is generated to trip the breaker.

**R7.1.3** Amount of peak system load associated with each set point, both in percent and in MW. The percentage peak system load shall be based on the entity's system load coincident with the previous year actual peak system load of the Balancing Authority.

**R7.2** The Generator Owner shall supply the following information as implemented in the field:

**R7.2.1** Generator protection underfrequency trip set points (Hz).

**R7.2.2** Indicate whether trip is manual or automatic.

**R7.2.3** Time delay (from initiation to trip signal) associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the signal is generated to trip the breaker.

**R7.2.3.1** For manual actuation, provide time based on plant specific guidance

**R7.2.3.2** For automatic actuation, provide time based on actual protection scheme design

**R7.2.4** Amount of generation tripped, in MW

**R7.2.5** Provide the data specified in R7.1 for any additional UFLS required in R6.

**R8** Coordination of UFLS programs with external entities shall be facilitated by the following requirements: [Violation Risk Factor: Lower]

**R8.1** Transmission Planners shall provide when requested a description of the UFLS schemes and the results of the UFLS study required in R3 and R4 to neighboring entities responsible for UFLS assessment external to SERC.

**R8.2** Transmission Planners shall request a description of the UFLS schemes and the results of the UFLS study from neighboring entities responsible for UFLS assessment external to SERC.

**C. Measures**

**D. Compliance**

**1 Compliance Monitoring Process**

**2 Violation Severity Levels**

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