A. Introduction

1. Title: Automatic Under Frequency Load Shedding Requirements

2. Number: PRC – 006 – RFC – 01

3. Purpose: To establish ReliabilityFirst requirements for automatic under frequency load shedding (UFLS) to support NERC Reliability Standard PRC-006.

4. Applicability:

- **4.1 Distribution Provider**
- **4.2 Transmission Owners**
- **4.3 Load Serving Entity**
- **4.4 Generator Owner owning a unit in ReliabilityFirst (or units in aggregate) with a total capacity of 20 MW or greater**
- **4.5 Transmission Operator operating a UFLS system**
- **4.6 Planning Coordinator**

5. (Proposed) Effective Date:

B. Requirements

R1 Load Serving Entities shall furnish data to their Distribution Providers and Transmission Owners with directly connected end use load in the Reliability*First* footprint as requested. These data shall include *[Violation Risk Factor: Medium]*:

R1.1 Forecasted load magnitude and profile

R1.2 Load characteristics (e.g. motor loads, etc.)

R1.3 Load significance (e.g. hospitals, etc.)

R1.4 Distributed generation characteristics (where applicable)

R2 Each Distribution Provider and Transmission Owner with directly connected end use load in the Reliability*First* footprint shall implement an automatic UFLS plan. Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint may contract to aggregate to satisfy their required automatic UFLS plan. The automatic UFLS plan shall include the following requirements: *[Violation Risk Factor: Higher]*

R2.1 Have the capability of shedding at least 25 percent of the forecasted peak hour load

R2.2 Shed load in a minimum of three steps

R2.3 Size each step equally (the variance between steps shall be no more than two percent of forecasted peak hour load)

R2.4 The first set point shall be no lower than 59.3 Hz and not higher than 59.5 Hz. The last set point shall be no lower than 58.5 Hz and not higher than 58.7 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 Intentional relay time delay shall be no greater than six cycles, with the following exceptions:

R2.6.1 For installations where large motor loads may be isolated, under current supervision is preferred to avoid false operation during fault isolation. If this is not available, intentional relay time delay may be increased to no greater than 15 cycles.

R2.6.2 For installations where distributed generation may be isolated, under current supervision is preferred to avoid false operation during fault isolation. If this is not available, intentional relay time delay may be increased to no greater than 15 cycles.

R2.6.3 For existing electromechanical relays that can not be set to six cycles, the intentional relay time delay may be increased to eight cycles.

R2.7 Under voltage inhibit (where applicable) shall be set as low as practical, but shall not be greater than 75 percent of nominal voltage

R3 Each Planning Coordinator in coordination with the Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint, shall have a documented process to assess areas (or sub areas) of probable islanding. The process shall consider at least the following to identify areas (or sub areas) of probable islanding *[Violation Risk Factor: Lower]*:

- Historical islanding scenarios
- Areas with limited number of feeds
- Areas with constrained MW import capability

R3.1 The Planning Coordinator shall use this process at least every five years to assess areas (or sub areas) of probable islanding within their area of responsibility.

R3.2 The Planning Coordinator shall supply the results of the assessment (within 30 days of completion of the assessment) to the Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint of identified areas (or sub areas) of probable islanding.

R3.3 Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint in identified areas (or sub areas) of probable islanding (as determined in R3) shall install UFLS capability in the island area in excess of the requirements in R2 so as to cover potential generation/load imbalances, in accordance with the Planning Coordinator recommendation. The amount of load to be shed in the island area and the corresponding relay trip and time delay settings shall be determined by appropriate engineering assessments that specifically address the islanding scenario.

R3.3.1 Identified areas (or sub areas) of probable islanding of 300 MW or less shall be exempt from any additional UFLS requirements per R3.3

R3.3.2 Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint are not required to install greater than 50 percent of the forecasted peak hour load in the identified areas (or sub areas) of probable islanding

R4 Each Generator Owner shall comply with the generator automatic under frequency minimum tripping time delays in the following table, *[Violation Risk Factor: Higher]*

Frequency (Hz)	Minimum Time Delay (Sec)
≥ 59.5	Automatic Frequency Dependent Tripping Not Permitted
<59.5 to > 59.2	2,700.0
≤59.2 to > 58.5	120.0
≤58.5 to > 58.2	15.0
≤58.2	Owner's Discretion

R4.1 In those cases where a generator must be tripped for its own protection outside the specifications in the above table, the Generator Owners may become compliant by arranging for sufficient load shedding in addition to that required in R2 to be installed within an adjacent Distribution Provider. This additional load shedding shall be equal to or greater than the generator MW dispatch, instituted at the same frequency and time as the generator would be expected to trip.

R5 Distribution Providers or Transmission Owners owning tie tripping schemes, islanding schemes, automatic load restoration schemes or any other schemes that are part of or impact the UFLS programs shall document such schemes in sufficient detail to allow modeling for dynamics simulations *[Violation Risk Factor: Medium]*.

R6 Distribution Providers, Transmission Owners, Planning Coordinators, and Generator Owners required to comply with R2, R3, R4, and R5 respectively, shall supply the following information, in the requested format to Reliability*First* to populate the RFC UFLS database at least every five years (Within 45 days of request). The information shall include *[Violation Risk Factor: Lower]*:

R6.1 Frequency Trip Points (TO or DP requirement)

R6.2 Percent of Forecasted Hourly Peak Load Dropped at each Trip Point (TO or DP requirement)

R6.3 Relay Operating Time Delay (TO or DP requirement)

R6.4 Circuit Breaker Operating Time (TO or DP requirement)

R6.5 UFLS relay undervoltage inhibit voltage level (TO or DP requirement)

R6.6 Information describing any other schemes that are part of or impact the UFLS program (TO or DP requirement)

R6.7 Under frequency trip setpoints and time delays of generating units (GO Requirement)

R6.8 Probable islanding areas (PC Requirement)

C. Measures

The following documentation will be used to determine compliance with the above requirements.

M1 The Load Serving Entity shall have documentation showing that the information requested in R1 was supplied to its Distribution Provider and Transmission Owner when requested.

M2 Every Distribution Provider and Transmission Owner with directly connected end use load in the Reliability*First* footprint shall have documentation showing they comply with all the requirements of R2.

M3 The Planning Coordinator shall have documentation detailing processes to assess areas of probable islanding giving consideration to the items listed in R3.The Planning Coordinator shall have evidence an assessment to determine if probable islands exist was performed within the past 5 years. Documentation that Planning Coordinator supplied to the applicable Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint the results of the assessment from R3.1.

M4 The Generator Owner shall have documentation that it complies with the frequency protection settings of generators or and arrangements for additional load shedding, if appropriate, as required in R4.

M5 Distribution Providers and/or Transmission Owners owning tie tripping schemes, islanding schemes, automatic load restoration schemes or any other schemes that

are part of or impact the UFLS programs shall have documentation of these schemes as required in R5 and evidence that this documentation was provided to the Planning Coordinator.

M6 The respective Distribution Providers and/or Transmission Owners shall have evidence that the information as required in R6 was supplied to Reliability*First* to populate the RFC UFLS Database.

D. Compliance

1 Compliance Monitoring Process

1.1 Compliance Monitoring Responsibility
Compliance Monitor: Reliability*First*

1.2 Compliance Monitoring Period and Reset
On request (within 30 calendar days)

1.3 Data Retention
5 years

1.4 Additional Compliance Information
None

2 Violation Severity Levels

2.1 Lower: There shall be a lower violation if any of the following conditions exist:

2.1.1 Total UFLS was less than 25 percent but greater than or equal to 23 percent of the forecasted peak hour load as required in R2.1.

2.1.2 Intentional relay time delays were greater than six cycles but less than or equal to eight cycles except as allowed by R2.6.1, R2.6.2 or 2.6.3, as required in R2.6.

2.1.3 Data to populate the RFC UFLS Database was provided, but was incomplete in one of the areas identified in R6.1 through R6.5.

2.2 Moderate: There shall be a moderate violation if any of the following conditions exist:

2.2.1 Information required in R1.2, R1.3 and R1.4 was not sent to the Distribution Provider and Transmission Owner with directly connected end use load in the Reliability*First* footprint by the Load Serving Entity as requested.

2.2.2 Total UFLS was less than 23 percent but greater than or equal to 21 percent of the forecasted peak hour load as required in R2.1

2.2.3 The UFLS plan steps were not equal to within two percent of the forecasted peak hour load as required in R2.3

2.2.4 Intentional relay time delays were greater than eight cycles but less than or equal to eleven cycles except as allowed by R2.6.1, R2.6.2 or R2.6.3, as required in R2.6.

2.2.5 Greater than zero but less than or equal to five percent of a Generator Owner's total MWs is tripped by frequency protection sooner than the minimum time delays required in the table in R4 without using the mitigation technique suggested in R4.1.

2.2.6 Planning Coordinators performed the assessment required in R3 but did not report the results to the Distribution Providers and/or Transmission Owners with directly connected end use load in the Reliability*First* footprint effected by the probable islanding, as required in R3.2

2.3 High: There shall be a high violation if any of the following conditions exist:

2.3.1 Total UFLS was less than 21 percent but greater than or equal to 18 percent of the forecasted peak hour load, as required in R2.1.

2.3.2 The difference between frequency set points was less than 0.2 Hz or greater than 0.5 Hz, as required in R2.5

2.3.3 Under voltage inhibit (where applicable) was set greater than 75 percent of nominal voltage, as required in R2.7

2.3.4 Intentional relay time delays were greater than eleven cycles but less than or equal to 15 cycles except as allowed by R2.6.1, R2.6.2 or R2.6.3, as required in R2.6.

2.3.5 Schemes that effect the UFLS plan as mentioned in R5 were not documented in sufficient detail for dynamics modeling.

2.3.6 Planning Coordinators did not perform the assessment required in R3.

2.4 Severe: There shall be a severe violation if any of the following conditions exists:

2.4.1 Information required in R1.1 was not sent to the Distribution Provider and Transmission Owner with directly connected end use load in the Reliability*First* footprint by the Load Serving Entity as requested.

2.4.2 Total UFLS was less than 18 percent of the forecasted peak hour load, as required in R2.1

2.4.3 The UFLS program contained less than three steps, as required in R2.2.

2.4.4 The first set point of the UFLS was less than 59.3 Hz or the last set point is lower than 58.5 Hz or higher than 58.7 Hz, as required in R2.4

2.4.5 Intentional relay time delays were greater than 15 cycles, as required in R2.6.

2.4.6 Greater than five percent of a Generator Owner's total MWs is tripped by frequency protection sooner than the minimum time delays required in the table in R4 without using the mitigation technique suggested in R4.1

2.4.7 Data to populate the RFC UFLS Database was provided, but was incomplete in two or more of the areas identified in R6.1 to 6.5.

2.4.8 For Generator Owners Only - Data to populate the RFC UFLS Database was provided, but was incomplete for R6.6.

E. Terms

F. IntraRegional Differences

None

G. Notes

Version History

Version	Date	Action	Change Tracking
PRC-006-RFC-01 1st Draft	???? Through ????	Posted for 1st Comment Period	