

Attachment A

BAL-003-1 Frequency Response & Frequency Bias Setting Standard

Supporting Document

Background

This document outlines the ERO process for supporting the Frequency Response Standard (FRS).

Event Selection Criteria

The ERO will use the following criteria to select FRS frequency excursion events for analysis.

1. The evaluation period for performing the annual Frequency Bias Setting and the Frequency Response Measure (FRM) calculation is December 1 of the prior year through November 30 of the current year.
2. At least 25 frequency excursion events in each Interconnection will be identified for calculating the Frequency Bias Setting and the FRM. If in a given evaluation period 25 frequency excursion events cannot be identified satisfying the limits specified in criteria 3 below, then similar acceptable events from the previous evaluation period also satisfying listed criteria will be included with the data set by NERC for determining FRS compliance.
3. Two limits will be used to determine if an acceptable frequency excursion event for determining FRM has occurred:
 - a. The change in frequency (delta F) and the arresting frequency (Point C) must exceed the excursion threshold values specified for the Interconnection in table 1 below. Point C is the arrested value of frequency observed within 8 seconds following the start of the excursion.

Interconnection	Delta F	Point C	
		Under Frequency	Over Frequency
East	0.04Hz	< 59.97	> 60.03
West	0.04Hz	< 59.97	> 60.03
Texas	0.15Hz	< 59.97	> 60.03
HQ	0.04Hz	< 59.97	> 60.03

Table 1: Interconnection Frequency Excursion Threshold Values

- b. The time from the start of the rapid change in frequency until the point at which Frequency has largely stabilized should be less than 18 seconds.
- 4. Pre-disturbance frequency should be relatively steady and near 60.000 Hz. The A Value is computed as an average over the period from -16 seconds to 0 seconds before the frequency transient begins to decline.
- 5. Events that coincide with a second event that does not stabilize before the first scan used in the B-Value should not be considered.
- 6. Frequency excursion events occurring during periods when large interchange schedule ramping or load change is happening, and frequency excursion events occurring within 5 minutes of the top of the hour, should be excluded from consideration if other acceptable frequency excursion events can be used for analysis.
- 7. Select the cleanest 2 or 3 frequency excursion events occurring monthly that satisfy selection criteria. If there are not 2 frequency excursion events satisfying selection criteria occurring during the month, then other frequency excursion events from the same season of the year satisfying selection criteria will be used.

To assist Balancing Authority preparation for complying with this standard, NERC will provide quarterly posting of candidate frequency excursion events likely to be used for the current year FRM calculation. NERC will post the final list of frequency excursion events used for standard compliance by December 15 each year. Balancing Authorities are encouraged to develop scanning tools that identify candidate frequency excursion events so they are ready to access data files when needed.

NOTE: *Additional frequency excursion events not satisfying the criteria specified may be used by the ERO for analysis of Interconnection performance however these events will not be used to calculate Balancing Authority frequency response.*

Frequency Response Obligation (FRO) for the Interconnection

Each Interconnection will establish target contingency protection criteria. The default target listed in Table 2 is based on the largest category C (N-2) event identified. This contingency protection criterion includes a safety margin to prevent Point C from encroaching on the interconnection highest Under Frequency Load Shed (UFLS) step for credible contingencies.

	Eastern	Western	Texas	HQ	
Starting Frequency	60	60	60	60	Hz
*Highest UFLS	59.6	59.5	59.3	58.5	Hz
Contingency Protection Criteria	4500	2740	275008	1700	MW
Base Obligation	1125	548	229387	113	MW/0.1Hz
With 25% Safety Margin	1406	685	286483	141	MW/0.1Hz

Table 2: Interconnection Frequency Response Obligations

*The Eastern Interconnection set point listed is a compromise value for the highest UFLS step setting of 59.5Hz used in the east and the special protection scheme highest UFLS step setting of 59.7Hz used in

Florida. It is extremely unlikely an event elsewhere in the Eastern Interconnection would cause the Florida UFLS special protection scheme to “false trip”.

An Interconnection may propose alternate FRO protection criteria to the ERO. The ERO will seek endorsement from the NERC Operating Committee and the NERC Planning Committee for alternate FRO protection criteria proposed.

Balancing Authority Frequency Response Obligation (FRO) and Frequency Bias Setting

The ERO and the NERC Resources Subcommittee (RS) will manage the administrative procedure for annually assigning an FRO and Frequency Bias Setting to each Balancing Authority.

For a multiple Balancing Authority interconnection, the Interconnection Frequency Response Obligation is allocated based on Balancing Authority size. Initial FRO allocation will be based on the following method:

$$\text{(Projected Balancing Authority Peak Load + Installed Capacity)/2}^1$$

NERC will collect peak load and capacity data on FRS Form 1 during January of each year. Once data for all Balancing Authorities has been validated, NERC will use FRS Form 1 data to post the following information for each Balancing Authority for the upcoming year:

- Frequency Bias Setting
- CPS Limits
- Frequency Response Obligation (FRO)

Assuming data entry is correct FRS Form 1 will automatically calculate the Balancing Authorities’ Frequency Bias Setting for the upcoming year. Once the data listed above is fully posted, NERC will announce the implementation date for changing the Frequency Bias Setting.

Frequency Response Measure (FRM)

Assuming data entry is correct; FRS Form 1 will automatically calculate the Balancing Authorities’ FRM for the past 12 months. NERC will compare the calculated FRM value to the previous year posted FRO to verify compliance.

The FRM will be computed from Single Event Frequency Response Data (SEFRD), defined as: “the data from an individual event from a Balancing Authority that is used to calculate its Frequency Response, expressed in MW/0.1Hz”. The SEFRD for a typical Balancing Authority in an Interconnection with more

¹ This allocation methodology is being evaluated as part of the draft standard field trial.

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Background Document

than one Balancing Authority is basically the change its Actual Net Interchange on its tie lines with its adjacent Balancing Authorities divided by the change in Interconnection frequency. (Some Balancing Authorities may choose to apply corrections to its Actual Net Interchange values to account for factors such as nonconforming loads. [FRS Form 1 shows the types of adjustments that are allowed.](#)) [A standardized sampling interval of 20 to 52 seconds will be used in the computation of SEFRD values.](#)

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A standardized sampling interval of 20 to 52 seconds will be used in the computation of SEFRD values. EXCEL spreadsheet interfaces for EMS scan rates of 2 through 6 seconds will be provided to support the computation. During the field trial, other sampling intervals will be evaluated as well to determine if another sampling interval is more appropriate.

In an attempt to balance the workload of Balancing Authorities with the need for accuracy in the FRM, the field trial will require 25 samples selected during the course of the year to compute the FRM. Limited research conducted by the Frequency Responsive Reserve Standard Drafting Team (FRSDT) indicated that a Balancing Authority's FRM will converge to a reasonably stable value with 20 to 25 samples. The FRSDT will re-evaluate the required number of samples during the field trial.

The FRSDT also performed a preliminary evaluation to determine an appropriate method for combining SEFRD values to compute the FRM. Based on limited initial analyses conducted for a few Balancing Authorities, the median has been chosen initially as the aggregation technique because it seems more resilient to other factors that impact Actual Net Interchange values during the occurrence of frequency events. Other aggregation techniques will be evaluated during the field trial to determine if another technique is more appropriate.

In order to support field trial evaluations of sample size, sampling intervals, and aggregation techniques, the FRSDT will be retrieving scan rate data from the Balancing Authorities for each SEFRD. Additional frequency events may also be requested for research purposes, though they will not be included in the FRM computation.