

Attachment A

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

Supporting Document

Frequency Response Obligation (FRO) for the Interconnection

The ERO, in consultation with regional representatives, has established a target contingency protection criteria for each Interconnection. The default target listed in Table 2 is based on the largest category C (N-2) event identified. Additionally, this contingency protection criterion includes a reliability margin to prevent Point C from encroaching on the interconnection’s highest Under Frequency Load Shed (UFLS) step for credible contingencies. The Base Obligation in Table 2-1 is calculated by dividing the Contingency Protection Criteria MWs by the difference between the Starting Frequency and the Target Minimum Frequency times 10 to arrive at a MW/.1 Hz number. The Reliability Margin is then added to arrive at the Interconnection FRO.

<u>Interconnection</u>	<u>Eastern</u>	<u>Western</u>	<u>ERCOT</u>	<u>HQ</u>	<u>Units</u>
<u>Target Protection Criteria</u>	<u>4,500</u>	<u>2,740</u>	<u>2,750</u>	<u>1,700</u>	<u>MW</u>
<u>Credit for Load Reduction</u>	<u>-</u>	<u>-300</u>	<u>-1,150</u>	<u>-</u>	<u>MW</u>
<u>Prevailing UFLS First Step</u>	<u>59.5</u>	<u>59.5</u>	<u>59.3</u>	<u>58.5</u>	<u>Hz</u>
<u>Frequency Margin (tenths)</u>	<u>5</u>	<u>5</u>	<u>7</u>	<u>15</u>	<u>0.1 Hz</u>
<u>Typical C to B Ratio</u>	<u>0.95</u>	<u>1.7</u>	<u>1.4</u>	<u>2</u>	<u>-</u>
<u>Necessary Frequency response</u>	<u>-855</u>	<u>-830</u>	<u>-320</u>	<u>-227</u>	<u>MW/0.1Hz</u>
<u>With Reliability Margin (25%)</u>	<u>-1,069</u>	<u>-1,037</u>	<u>-400</u>	<u>-283</u>	<u>MW/0.1Hz</u>
	Eastern	Western	ERCOT	HQ	
Starting Frequency	60	60	60	60	Hz
*Target Minimum Frequency	59.6	59.5	59.3	58.5	Hz

Contingency Protection Criteria	4500	2740 2340	2750	1700	M W
**Base Obligation	1125	548 468	229	113	MW/0.1Hz
Interconnection FRO (includes 25% Reliability Margin)	1406	685 585	286	141	MW/0.1Hz

Table 1: 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 highest UFLS step setting of 59.7Hz used in Florida. It is extremely unlikely that an event elsewhere in the Eastern Interconnection would cause the Florida UFLS step to “false-trip”.*

***In the Base Obligation measure for ERCOT, 1150 MW (Load Resources triggered by Under Frequency Relays at 59.70 Hz) was reduced from its Contingency Protection Criteria level of 2750 MW to get 229 MW/0.1 Hz. This was reduced to accurately account for designed response from Load Resources within 30 cycles.*

An Interconnection may propose alternate FRO protection criteria to the ERO by submitting a SAR with supporting technical documentation.

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

The ERO will manage the administrative procedure for annually assigning an FRO and implementation of the Frequency Bias Setting for each Balancing Authority.

For a multiple Balancing Authority interconnection, the Interconnection Frequency Response Obligation shown in ~~Table 2~~ Table 1 is allocated based on the Balancing Authority ~~Peak Demand~~ annual load and ~~peak annual~~ generation. The FRO allocation will be based on the following method:

$$FRO_{BA} = FRO_{Int} \times \frac{\text{Peak Gen}_{BA} + \text{Peak Load}_{BA}}{\text{Peak Gen}_{Int} + \text{Peak Load}_{Int}}$$

$$FRO_{BA} = FRO_{Int} \times \frac{\text{Annual Gen}_{BA} + \text{Annual Load}_{BA}}{\text{Annual Gen}_{Int} + \text{Annual Load}_{Int}}$$

Where:

- Peak Annual Gen_{BA} is the average of monthly total annual “Output of Generating Plants” within the Balancing Authority Area (BAA), on FERC Form 714, column ~~f~~ of Part II - Schedule 3.
- Peak Annual Load_{BA} is the average of total annual Load within the BAA “Monthly Peak Demand (MW)”, on FERC Form 714, column j of Part II - Schedule 3.
- Peak Annual Gen_{Int} is the sum of all Peak Annual Gen_{BA} values reported in that interconnection.

- Peak-Annual Load_{int} is the sum of all Peak-Annual Load_{BA} values reported in that interconnection.

The data used for this calculation is from the most recently filed Form 714. As an example, a report to NERC in January 2013 would use the Form 714 data filed in 2012, which utilized data from 2011.

Balancing Authorities that are not FERC jurisdictional should use the Form 714 Instructions to assemble and submit equivalent data to the ERO for use in the FRO Allocation process.

Balancing Authorities that elect to form a FRSG will calculate a FRSG FRO by summing the individual BA FRO's.

Balancing Authorities that elect to form a FRSG as a means to jointly meet the FRO will calculate their FRM performance one of two ways:

- Calculate a group NI_A and measure the group response to all events in the reporting year on a single FRS Form 1, or
- Jointly submit the individual BAs' Form 1s, with a summary spreadsheet that sums each participant's individual event performance.

Balancing Authorities that merge or that transfer load or generation are encouraged to notify the ERO of the change in footprint and corresponding changes in allocation such that the net obligation to the Interconnection remains the same and so that CPS limits can be adjusted.

Each Balancing Authority reports its previous year's Frequency Response Measure (FRM), Frequency Bias Setting and Frequency Bias type (fixed or variable) to the ERO by February 10 each year to allow the ERO to validate the revised Frequency Bias Settings on FRS Form 1. If the ERO posts the official list of events after January 10, Balancing Authorities will be given 30 days from the date the ERO posts the official list of events to submit their FRS Form 1.

Once the ERO validates-reviews the data submitted in FRS Form 1 and FRS Form 2 for all Balancing Authorities, the ERO will use FRS Form 1 data to post the following information for each Balancing Authority for the upcoming year:

- Frequency Bias Setting
- Frequency Response Obligation (FRO)

Once the data listed above is fully posted, the ERO will announce the three-day implementation period for changing the Frequency Bias Setting.

A BA using a fixed Frequency Bias Setting sets its Frequency Bias Setting to the greater of (in absolute value):

- Any number the BA chooses between 100% and 125% of its Frequency Response Measure as calculated on FRS Form 1
- Interconnection Minimum as determined by the ERO

For purposes of calculating the minimum Frequency Bias Setting, a Balancing Authority participating in a Frequency Response Sharing Group will need to calculate its stand-alone Frequency Response Measure using FRS Form 1 and FRS Form 2 to determine its minimum Frequency Bias Setting.

A Balancing Authority providing Overlap Regulation will report the historic peak demand and generation of its combined BAs' areas on FRS Form 1 as described in Requirement R4.

Frequency Response Measure (FRM)

The Balancing Authority will calculate its FRM 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" as calculated on FRS Form 2 for each event shown on FRS Form 1. The SEFRD for a typical Balancing Authority in an Interconnection with more than one Balancing Authority is basically the change in its Net Actual 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 their Net Actual Interchange (NA_i) values to account for factors such as nonconforming loads. FRS Form 1 shows the types of adjustments that are allowed.) The ERO will use a standardized sampling interval of approximately 16 seconds before the event up to the time of the event for the pre-event NA_i and frequency (A values) and approximately 20 to 52 seconds after the event for the post-event NA_i (B values) in the computation of SEFRD values, dependent on the data scan rate of the Balancing Authority's Energy Management System (EMS).

Assuming data entry is correct FRS Form 1 will automatically calculate the Balancing Authority's FRM for the past 12 months as the median of the SEFRD values. A Balancing Authority electing to report as an FRSG or a provider of Overlap Regulation Service will provide an FRS Form 1 for the aggregate of its participants.

Events with a "Point C" that causes the Interconnection Frequency to be lower than that shown in Table 1 above (or higher than an equal change in frequency going above 60 Hz) may be included in the list of events for that interconnection. However, the calculation of the BA response to such an event will be adjusted to show a frequency change only to the Target Minimum Frequency shown in Table 1 above (or a high frequency amount of an equal quantity).