

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~~criteria^[A1] for each Interconnection. The default target listed in Table 12 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 for each Interconnection in Table 2-1 is calculated by dividing the ~~Contingency~~Target Protection Criteria MWs by the difference between ~~the Starting Frequency and the Target Minimum Frequency~~ 60 Hz and the Prevailing UFLS First Step times 10 ~~times the C to B Ratio~~ 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>-1,400</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>1.08</u>	<u>1.37</u>	<u>1.24</u>	<u>2.15</u>	<u>-</u>
<u>Necessary Frequency response</u>	<u>-972</u>	<u>-669</u>	<u>-239</u>	<u>-244</u>	<u>MW/0.1Hz</u>
<u>With Reliability Margin (25%)</u>	<u>-1,215</u>	<u>-836</u>	<u>-299</u>	<u>-305</u>	<u>MW/0.1Hz</u>

<u>Eastern</u>	<u>Western</u>	<u>ERCOT</u>	<u>HQ</u>
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Table 1: Interconnection Frequency Response Obligations

**The Eastern Interconnection UFLS set point listed is a compromise value set midway between the stable frequency minimum established in PRC-006-1 (59.3 Hz) and the local protection UFLS setting of 59.7 Hz used in Florida and Manitoba 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, 1400150 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 2329 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. The annual timeline for all activities described in this section are shown below.

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

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

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

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

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 cf 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 je 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~~ the date specified in the timeline below, 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 if it differs from that shown in the timeline below.

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.

There are occasions when changes are needed to Bias Settings outside of the normal schedule. Examples are footprint changes between Balancing Authorities and major changes in load or generation or the formation of new Balancing Authorities. In such cases the changing Balancing Authorities will work with their Regions, NERC and the Resources Subcommittee to confirm appropriate changes to Bias Settings, FRO, CPS limits and Inadvertent Interchange balances.

If there is no net change to the Interconnection total Bias, the Balancing Authorities involved will agree on a date to implement their respective change in Bias Settings. The Balancing Authorities and ERO will also agree to the allocation of FRO such that the sum remains the same.

If there is a net change to the Interconnection total Bias, this will cause a change in CPS2 limits and FRO for other Balancing Authorities in the Interconnection. In this case, the ERO will notify the impacted Balancing Authorities of their respective changes and provide an implementation window for making the Bias Setting changes.

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 events in FRS Form 1 are selected by the ERO using the Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard. 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.

To allow Balancing authorities to plan its operations, events with a “Point C” that causes the Interconnection Frequency to be lower than that shown in Table 1 above (for example, an event in the Eastern Interconnection that causes the Interconnection Frequency to go to 59.4 Hz) 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 (in the previous example this adjustment would cause Frequency to be shown as 59.5 Hz rather than 59.4 Hz) or a high

frequency amount of an equal quantity). Should such an event happen, the ERO will provide additional guidance.

The FRM reporting timeline is included in the timeline provided below.

Timeline for Balancing Authority Frequency Response and Frequency Bias Setting Activities

Described below is the timeline for the exchange of information between the ERO and Balancing Authorities (BA) to:

- Facilitate the assignment of BA Frequency Response Obligations (FRO)
- Calculate BA Frequency Response Measures (FRM)
- Determine BA Frequency Bias Settings (FBS)

<u>Target Date</u>	<u>Activity</u>
<u>April 30</u>	<u>The ERO reviews candidate frequency events and selects frequency events for the first quarter (December to February)</u>
<u>May 10</u>	<u>Form1 is posted with selected events from the first quarter for BA usage by the ERO.</u>
<u>May 15</u>	<u>The BAs receive a request to provide load and generation data as described in Attachment A to support FRO assignments and determining minimum FBS for BAs.</u>
<u>July 15</u>	<u>The BAs provide load and generation data as described in Attachment A to the ERO.</u>
<u>July 30</u>	<u>The ERO reviews candidate frequency events and selects frequency events for the second quarter (March to May)</u>
<u>August 10</u>	<u>Form1 is posted with selected events from the first and second quarters for BA usage by the ERO.</u>
<u>October 30</u>	<u>The ERO reviews candidate frequency events and selects frequency events for the third quarter (June to August)</u>
<u>November 10</u>	<u>Form1 is posted with selected events from the first, second, and third quarters for BA usage by the ERO.</u>
<u>November 20</u>	<u>If necessary, the ERO provides any updates to the Necessary Frequency Response with Reliability Margin.</u>
<u>November 20</u>	<u>The ERO provides the fractional responsibility of each BA for the Interconnection's FRO and Minimum FBS to the BAs.</u>
<u>January 30</u>	<u>The ERO reviews candidate frequency events and selects frequency events for the</u>

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	<u>fourth quarter (September to November)</u>
<u>2nd business day in February</u>	<u>Form1 is posted with all selected events for the year for BA usage by the ERO.</u>
<u>February 10</u>	<u>The ERO assigns FRO values to the BAs for the upcoming year.</u>
<u>March 7</u>	<u>BAs complete their frequency response sampling for all four quarters and their FBS calculation, returning the results to the ERO.</u>
<u>March 24</u>	<u>The ERO validates FBS values, computes the sum of all FBS values for each Interconnection, and determines L10 values for the CPS 2 criterion for each BA as applicable.</u>
<u>Any time during first 3 business days of April (unless specified otherwise by the ERO)</u>	<u>The BA implements any changes to their FBS and L10 value.</u>