

### A. Introduction

1. **Title:** Real Power Balancing Control Performance
2. **Number:** BAL-001-2
3. **Purpose:** To control Interconnection frequency within defined limits.
4. **Applicability:**
  - 4.1. **Balancing Authority**
    - 4.1.1 A Balancing Authority receiving Overlap Regulation Service is not subject to Control Performance Standard 1 (CPS1) or Balancing Authority ACE Limit (BAAL) compliance evaluation.
    - 4.1.2 A Balancing Authority that is a member of a Regulation Reserve Sharing Group is the Responsible Entity only in periods during which the Balancing Authority is not in active status under the applicable agreement or the governing rules for the Regulation Reserve Sharing Group.
  - 4.2. **Regulation Reserve Sharing Group**
5. **(Proposed) Effective Date:**
  - 5.1. First day of the first calendar quarter that is twelve months beyond the date that this standard is approved by applicable regulatory authorities, or in those jurisdictions where regulatory approval is not required, the standard becomes effective the first day of the first calendar quarter that is twelve months beyond the date this standard is approved by the NERC Board of Trustees, or as otherwise made effective pursuant to the laws applicable to such ERO governmental authorities.

### B. Requirements

- R1. The Responsible Entity shall operate such that the Control Performance Standard 1 (CPS1), calculated in accordance with Attachment 1, is greater than or equal to 100 percent for the applicable Interconnection in which it operates for each preceding 12 consecutive calendar month period, evaluated monthly. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- R2. Each Balancing Authority shall operate such that its clock-minute average of Reporting ACE does not exceed its clock-minute Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes, calculated in accordance with Attachment 2, for the applicable Interconnection in which the Balancing Authority operates. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

### C. Measures

- M1. The Responsible Entity shall provide evidence, upon request, such as dated calculation output from spreadsheets, system logs, software programs, or other evidence (either in hard copy or electronic format) to demonstrate compliance with Requirement R1.

- M2.** Each Balancing Authority shall provide evidence, upon request, such as dated calculation output from spreadsheets, system logs, software programs, or other evidence (either in hard copy or electronic format) to demonstrate compliance with Requirement R2.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1. Compliance Enforcement Authority**

As defined in the NERC Rules of Procedure, “Compliance Enforcement Authority” means NERC or the Regional Entity in their respective roles of monitoring and enforcing compliance with the NERC Reliability Standards.

##### **1.2. Data Retention**

The following evidence retention periods identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full-time period since the last audit.

The Responsible Entity shall retain data or evidence to show compliance for the current year, plus three previous calendar years unless, directed by its Compliance Enforcement Authority, to retain specific evidence for a longer period of time as part of an investigation. Data required for the calculation of Regulation Reserve Sharing Group Reporting Ace, or Reporting ACE, CPS1, and BAAL shall be retained in digital format at the same scan rate at which the Reporting ACE is calculated for the current year, plus three previous calendar years.

If a Responsible Entity is found noncompliant, it shall keep information related to the noncompliance until found compliant, or for the time period specified above, whichever is longer.

The Compliance Enforcement Authority shall keep the last audit records and all subsequent requested and submitted records.

##### **1.3. Compliance Monitoring and Assessment Processes**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Investigation

Self-Reporting

Complaints

**1.4. Additional Compliance Information**

None.

**2. Violation Severity Levels**

| R # | Lower VSL                                                                                                                                                                                               | Moderate VSL                                                                                                                                                                                            | High VSL                                                                                                                                                                                                | Severe VSL                                                                                                                                                     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1  | The CPS 1 value of the Responsible Entity, for the preceding 12 consecutive calendar month period, is less than 100 percent but greater than or equal to 95 percent for the applicable Interconnection. | The CPS 1 value of the Responsible Entity, for the preceding 12 consecutive calendar month period, is less than 95 percent, but greater than or equal to 90 percent for the applicable Interconnection. | The CPS 1 value of the Responsible Entity, for the preceding 12 consecutive calendar month period, is less than 90 percent, but greater than or equal to 85 percent for the applicable Interconnection. | The CPS 1 value of the Responsible Entity, for the preceding 12 consecutive calendar month period, is less than 85 percent for the applicable Interconnection. |
| R2  | The Balancing Authority exceeded its clock-minute BAAL for more than 30 consecutive clock minutes but for 45 consecutive clock-minutes or less for the applicable Interconnection.                      | The Balancing Authority exceeded its clock-minute BAAL for greater than 45 consecutive clock minutes but for 60 consecutive clock-minutes or less for the applicable Interconnection.                   | The Balancing Authority exceeded its clock-minute BAAL for greater than 60 consecutive clock minutes but for 75 consecutive clock-minutes or less for the applicable Interconnection.                   | The Balancing Authority exceeded its clock-minute BAAL for greater than 75 consecutive clock-minutes for the applicable Interconnection.                       |

**E. Regional Variances**

None.

**F. Associated Documents**

BAL-001-2, Real Power Balancing Control Performance Standard Background Document

**Version History**

| <b>Version</b> | <b>Date</b>       | <b>Action</b>                                                                                                                                                                                | <b>Change Tracking</b> |
|----------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 0              | February 8, 2005  | BOT Approval                                                                                                                                                                                 | New                    |
| 0              | April 1, 2005     | Effective Implementation Date                                                                                                                                                                | New                    |
| 0              | August 8, 2005    | Removed “Proposed” from Effective Date                                                                                                                                                       | Errata                 |
| 0              | July 24, 2007     | Corrected R3 to reference M1 and M2 instead of R1 and R2                                                                                                                                     | Errata                 |
| 0a             | December 19, 2007 | Added Appendix 2 – Interpretation of R1 approved by BOT on October 23, 2007                                                                                                                  | Revised                |
| 0a             | January 16, 2008  | In Section A.2., Added “a” to end of standard number<br><br>In Section F, corrected automatic numbering from “2” to “1” and removed “approved” and added parenthesis to “(October 23, 2007)” | Errata                 |
| 0              | January 23, 2008  | Reversed errata change from July 24, 2007                                                                                                                                                    | Errata                 |
| 0.1a           | October 29, 2008  | Board approved errata changes; updated version number to “0.1a”                                                                                                                              | Errata                 |
| 0.1a           | May 13, 2009      | Approved by FERC                                                                                                                                                                             |                        |
| 1              |                   | Inclusion of BAAL and WECC Variance and exclusion of CPS2                                                                                                                                    | Revision               |
| 1              | December 19, 2012 | Adopted by NERC Board of Trustees                                                                                                                                                            |                        |
| 2              | August 15, 2013   | Adopted by the NERC Board of Trustees                                                                                                                                                        |                        |
| 2              | April 16, 2015    | FERC Order issued approving BAL-001-2                                                                                                                                                        |                        |

**Attachment 1**  
**Equations Supporting Requirement R1 and Measure M1**

CPS1 is calculated as follows:

$$CPS1 = (2 - CF) * 100\%$$

The frequency-related compliance factor (CF), is a ratio of the accumulating clock-minute compliance parameters for the most recent preceding 12 consecutive calendar months, divided by the square of the target frequency bound:

$$CF = \frac{CF_{12\text{-month}}}{(\epsilon_{1I})^2}$$

Where  $\epsilon_{1I}$  is the constant derived from a targeted frequency bound for each Interconnection as follows:

- Eastern Interconnection  $\epsilon_{1I} = 0.018$  Hz
- Western Interconnection  $\epsilon_{1I} = 0.0228$  Hz
- ERCOT Interconnection  $\epsilon_{1I} = 0.030$  Hz
- Quebec Interconnection  $\epsilon_{1I} = 0.021$  Hz

The rating index  $CF_{12\text{-month}}$  is derived from the most recent preceding 12 consecutive calendar months of data. The accumulating clock-minute compliance parameters are derived from the one-minute averages of Reporting ACE, Frequency Error, and Frequency Bias Settings.

A clock-minute average is the average of the reporting Balancing Authority's valid measured variable (i.e., for Reporting ACE (RACE) and for Frequency Error) for each sampling cycle during a given clock-minute.

$$\left( \frac{RACE}{-10B} \right)_{\text{clock-minute}} = \frac{\left( \frac{\sum RACE_{\text{sampling cycles in clock-minute}}}{n_{\text{sampling cycles in clock-minute}}} \right)}{-10B}$$

And,

$$\Delta F_{\text{clock-minute}} = \frac{\sum \Delta F_{\text{sampling cycles in clock-minute}}}{n_{\text{sampling cycles in clock-minute}}}$$

The Balancing Authority's clock-minute compliance factor ( $CF_{\text{clock-minute}}$ ) calculation is:

$$CF_{\text{clock-minute}} = \left[ \left( \frac{RACE}{-10B} \right)_{\text{clock-minute}} * \Delta F_{\text{clock-minute}} \right]$$

Normally, 60 clock-minute averages of the reporting Balancing Authority's Reporting ACE and Frequency Error will be used to compute the hourly average compliance factor ( $CF_{\text{clock-hour}}$ ).

$$CF_{\text{clock-hour}} = \frac{\sum CF_{\text{clock-minute}}}{n_{\text{clock-minutesamples in hour}}}$$

The reporting Balancing Authority shall be able to recalculate and store each of the respective clock-hour averages ( $CF_{\text{clock-hour average-month}}$ ) and the data samples for each 24-hour period (one for each clock-hour; i.e., hour ending (HE) 0100, HE 0200, ..., HE 2400). To calculate the monthly compliance factor ( $CF_{\text{month}}$ ):

$$CF_{\text{clock-hour average-month}} = \frac{\sum [(CF_{\text{clock-hour}})(n_{\text{one-minutesamples in clock-hour}})]}{\sum [n_{\text{one-minutesamples in clock-hour}}]_{\text{days-in month}}}$$

$$CF_{\text{month}} = \frac{\sum [(CF_{\text{clock-hour average-month}})(n_{\text{one-minutesamples in clock-hour averages}})]}{\sum [n_{\text{one-minutesamples in clock-hour averages}}]_{\text{hours-in day}}}$$

To calculate the 12-month compliance factor ( $CF_{12 \text{ month}}$ ):

$$CF_{12\text{-month}} = \frac{\sum_{i=1}^{12} (CF_{\text{month-}i})(n_{(\text{one-minutesamples in month})-i})}{\sum_{i=1}^{12} [n_{(\text{one-minutesamples in month})-i}]}$$

To ensure that the average Reporting ACE and Frequency Error calculated for any one-minute interval is representative of that time interval, it is necessary that at least 50 percent of both the Reporting ACE and Frequency Error sample data during the one-minute interval is valid. If the recording of Reporting ACE or Frequency Error is interrupted such that less than 50 percent of the one-minute sample period data is available or valid, then that one-minute interval is excluded from the CPS1 calculation.

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority calculates its CPS1 performance after combining its Reporting ACE and Frequency Bias

Settings with the Reporting ACE and Frequency Bias Settings of the Balancing Authority receiving the Regulation Service.

## Attachment 2

### Equations Supporting Requirement R2 and Measure M2

When actual frequency is equal to Scheduled Frequency,  $BAAL_{High}$  and  $BAAL_{Low}$  do not apply.

When actual frequency is less than Scheduled Frequency,  $BAAL_{High}$  does not apply, and  $BAAL_{Low}$  is calculated as:

$$BAAL_{Low} = (-10B_i \times (FTL_{Low} - F_S)) \times \frac{(FTL_{Low} - F_S)}{(F_A - F_S)}$$

When actual frequency is greater than Scheduled Frequency,  $BAAL_{Low}$  does not apply and the  $BAAL_{High}$  is calculated as:

$$BAAL_{High} = (-10B_i \times (FTL_{High} - F_S)) \times \frac{(FTL_{High} - F_S)}{(F_A - F_S)}$$

Where:

**$BAAL_{Low}$**  is the Low Balancing Authority ACE Limit (MW)

**$BAAL_{High}$**  is the High Balancing Authority ACE Limit (MW)

**10** is a constant to convert the Frequency Bias Setting from MW/0.1 Hz to MW/Hz

**$B_i$**  is the Frequency Bias Setting for a Balancing Authority (expressed as MW/0.1 Hz)

**$F_A$**  is the measured frequency in Hz.

**$F_S$**  is the scheduled frequency in Hz.

**$FTL_{Low}$**  is the Low Frequency Trigger Limit (calculated as  $F_S - 3\epsilon_{1i}$  Hz)

**$FTL_{High}$**  is the High Frequency Trigger Limit (calculated as  $F_S + 3\epsilon_{1i}$  Hz)

Where  $\epsilon_{1i}$  is the constant derived from a targeted frequency bound for each Interconnection as follows:

- Eastern Interconnection  $\epsilon_{1i} = 0.018$  Hz
- Western Interconnection  $\epsilon_{1i} = 0.0228$  Hz
- ERCOT Interconnection  $\epsilon_{1i} = 0.030$  Hz
- Quebec Interconnection  $\epsilon_{1i} = 0.021$  Hz

To ensure that the average actual frequency calculated for any one-minute interval is representative of that time interval, it is necessary that at least 50% of the actual frequency sample data during that one-minute interval is valid. If the recording of actual frequency is interrupted such that less than 50 percent of the one-minute sample period

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data is available or valid, then that one-minute interval is excluded from the BAAL calculation and the 30-minute clock would be reset to zero.

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority calculates its BAAL performance after combining its Frequency Bias Setting with the Frequency Bias Setting of the Balancing Authority receiving Overlap Regulation Service.