

**Standard Development Roadmap**

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

**Development Steps Completed:**

1. The SAR for Project 2007-18 Reliability Based Controls was posted for a 30 day formal comment period on May 15, 2007.
2. A revised SAR for Project 2007-05 Reliability Based Controls was posted for a second 30 day formal comment period on September 10, 2007.
3. The Standards Committee approved Project 2007-18 Reliability Based Controls to be moved to standard drafting on December 11, 2007.
4. The SAR for Project 2007-05 Balancing Authority Controls was posted for a 30 day formal comment period on July 3, 2007.
5. The Standards Committee approved Project 2007-05 Balancing Authority Controls to be moved to standard drafting on January 18, 2008.
6. The Standards Committee approved the merger of Project 2007-05 Balancing Authority Controls and Project 2007-18 Reliability-based Control as Project 2010-14 Balancing Authority Reliability-based Controls on July 28, 2010.
7. The NERC Standards Committee approved breaking Project 2010-14 Balancing Authority Reliability-based Controls into two phases and moving Phase 1 (Project 2010-14.1 Balancing Authority Reliability-based Controls – Reserves) into formal standards development on July 13, 2011.

**Proposed Action Plan and Description of Current Draft:**

This is the first posting of the proposed new standard in accordance with Results-Based Criteria. This proposed draft standard will be posted for a 30-day formal comment period beginning on December ??, 2011 through January ??, 2012.

**Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
1. Second posting	May/June 2012
2. Initial Ballot	June 2012
3. Recirculation Ballot	September 2012
4. NERC BOT adoption.	October 2012

### Definitions of Terms Used in Standard

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Glossary.*

**Balancing Authority ACE Limit (BAAL):** The limit beyond which a Balancing Authority contributes more than its share of Interconnection frequency control reliability risk. This definition applies to a high limit (BAAL<sub>High</sub>) and a low limit (BAAL<sub>Low</sub>).

**Reporting ACE:** The scan rate values of a Balancing Authority's Area Control Error (ACE) measured in MW as defined in BAL-001 which includes the difference between the Balancing Authority's actual interchange and its scheduled interchange plus its frequency bias obligation plus any known meter error.

**Interconnection:** When capitalized, any one of the ~~four~~three major electric system networks in North America: Eastern, Western, Texas and Quebec~~ERCOT~~.

## **A. Introduction**

- 1. Title: Real Power Balancing Control Performance**
- 2. Number: BAL-001-1**
- 3. Purpose: To control Interconnection frequency within defined limits in support of interconnection frequency.**
- 4. Applicability:**
  - 4.1. Balancing Authority**
- 5. (Proposed) Effective Date:**
  - 5.1.** In those jurisdictions where regulatory approval is required this standard shall become effective the first calendar day of the first calendar quarter six (6) months after applicable regulatory approval.
  - 5.2.** In those jurisdictions where no regulatory approval is required this standard shall become effective the first calendar day of the first calendar quarter six (6) months after Board of Trustees adoption.

## **B. Requirements**

- R1.** Each Balancing Authority shall operate such that, on a rolling 12-month basis, the Balancing Authority's Control Performance Standard 1 (CPS1), as calculated in Attachment 1, is greater than or equal to 100% for the applicable Interconnection in which it operates to support interconnection frequency. [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Assessment*]
- 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), as calculated in Attachment 2, for more than 30 consecutive clock-minutes for the applicable Interconnection in which it operates to support interconnection frequency. [*Violation Risk Factor: Medium*] [*Time Horizon: Real-time Operations*]

## **C. Measures**

- M1.** Each Balancing Authority shall provide evidence upon request, such as dated calculation output, 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, either in hard copy or electronic format to demonstrate compliance with Requirement R2.

## **D. Compliance**

- 1. Compliance Monitoring Process**
  - 1.1. Compliance Enforcement Authority**

The Regional Entity is the Compliance Enforcement Authority except where the responsible entity works for the Regional Entity. Where the responsible entity works for the Regional Entity, the Regional Entity will establish an agreement

with the ERO or another entity approved by the ERO and FERC (i.e. another Regional Entity), to be responsible for compliance enforcement.

**1.2. Data Retention**

The Balancing Authority shall retain data or evidence to show compliance for the current year plus three 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 Reporting ACE, CPS1, and BAAL shall be retained for the current year plus three calendar years.

If a Balancing Authority is found non-compliant, it shall keep information related to the non-compliance 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 Violation Investigations
- Self-Reporting
- Complaints
- Periodic Data Submittals

**1.4. Additional Compliance Information**

None.

**2. Violation Severity Levels**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	The Balancing Authority Area’s value of CPS1, on a rolling 12-month basis, is less than 100% but greater than or equal to 95% for the applicable	The Balancing Authority Area’s value of CPS1, on a rolling 12-month basis, is less than 95% but greater than or equal to 90% for the applicable	The Balancing Authority Area’s value of CPS1, on a rolling 12-month basis, is less than 90% but greater than or equal to 85% for the applicable	The Balancing Authority Area’s value of CPS1, on a rolling 12-month basis, is less than 85% for the applicable Interconnection.

**Standard BAL-001-1 – Real Power Balancing Control Performance**

	Interconnection.	Interconnection.	Interconnection.	
R2	The Balancing Authority exceeded its clock-minute BAAL for more than 30 consecutive clock-minutes but less than or equal to 45 consecutive clock-minutes.	The Balancing Authority exceeded its clock-minute BAAL for greater than 45 consecutive clock-minutes but less than or equal to 60 consecutive clock-minutes.	The Balancing Authority exceeded its clock-minute BAAL for greater than 60 consecutive clock-minutes but less than or equal to 75 consecutive clock-minutes.	The Balancing Authority exceeded its clock-minute BAAL for greater than 75 consecutive clock-minutes.

**E. Regional Variances**

None.

**F. Associated Documents**

BAL-001-1 Real Power Balancing Control Performance Standard Background Document

**Version History**

Version	Date	Action	Change Tracking
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 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	

## Standard BAL-001-1 – Real Power Balancing Control Performance

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1		Inclusion of BAAL and exclusion of CPS2	Revision

**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 all one-minute compliance parameters accumulated over 12 months divided by square of the target frequency bound:

$$CF = \frac{CF_{12\text{-month}}}{(\epsilon_1)^2}$$

where  $\epsilon_1$  is the constant derived from a targeted frequency bound for each Interconnection as follows:

- Eastern Interconnection  $\epsilon_1 = 0.018$  Hz
- Western Interconnection  $\epsilon_1 = 0.0228$  Hz
- ERCOT Interconnection  $\epsilon_1 = 0.030$  Hz
- Hydro-Quebec Interconnection  $\epsilon_1 = 0.021$  Hz

The rating index  $CF_{12\text{-month}}$  is derived from 12 months of data. The basic unit of data comes from one-minute averages of Reporting ACE, Frequency Error, and Frequency Bias Settings.

Reporting ACE is calculated as follows:

$$\text{Reporting ACE} = (NI_A - NI_S) - 10B (F_A - F_S) - NME$$

Where:

**NI<sub>A</sub> (Net Interchange Actual)** is the algebraic sum of actual transfers of Megawatts metered across all Tie Lines and Pseudo-Ties (BAs directly connected via asynchronous tie to another Interconnection may include or exclude those tie lines in their actual interchange).

**NI<sub>S</sub> (Net Interchange Schedule)** is the algebraic sum of all scheduled transfers, including Dynamic Schedules, of Megawatts to or from any adjacent Balancing Authorities incorporating the effects of schedule ramping (BAs directly connected via asynchronous tie to another Interconnection may include or exclude those tie lines in their scheduled interchange).

**B (Frequency Bias)** is the Frequency Bias Setting (in negative MW per 0.1 Hz) for the Balancing Authority.

**10** is the constant factor that converts the frequency bias setting to MW per Hz.

**F<sub>A</sub> (Actual Frequency)** is the measured frequency in hertz, to a minimum resolution of plus or minus 0.0005 Hz.

**F<sub>S</sub> (Scheduled Frequency)** is the scheduled frequency in hertz for the Interconnection. F<sub>S</sub> is normally 60 Hz but may be offset to effect manual time error corrections.

**NME (Net Meter Error)** is the meter error correction factor based on the difference between the integrated hourly average of the net tie line flows (NIA) and the hourly net interchange energy measurement (megawatt-hour).

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

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

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

The Balancing Authority’s clock-minute compliance factor (CF) becomes:

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

Normally, sixty (60) clock-minute averages of the reporting Balancing Authority’s Reporting ACE and of the respective Interconnection’s Frequency Error will be used to compute the respective hourly average compliance parameter.

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

The reporting Balancing Authority shall be able to recalculate and store each of the respective clock-hour averages (CF clock-hour average-month) as well as the respective number of samples for each of the twenty-four (24) hours (one for each clock-hour, i.e., hour-ending (HE) 0100, HE 0200, ..., HE 2400).

$$CF_{\text{clock-hour average-month}} = \frac{\sum_{\text{days-in-month}} [(CF_{\text{clock-hour}})(n_{\text{one-minute samples in clock-hour}})]}{\sum_{\text{days-in month}} [n_{\text{one-minute samples in clock-hour}}]}$$



$$CF_{\text{month}} = \frac{\sum_{\text{hours-in-day}} [(CF_{\text{clock-hour average-month}})(n_{\text{one-minute samples in clock-hour averages}})]}{\sum_{\text{hours-in-day}} [n_{\text{one-minute samples in clock-hour averages}}]}$$

The 12-month compliance factor becomes:

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

In order to ensure that the average Reporting ACE and Frequency Error calculated for any one-minute interval is representative of that one-minute interval, it is necessary that at least 50% of both Reporting ACE and Frequency Error samples during that one-minute interval be present. Should a sustained interruption in the recording of Reporting ACE or Frequency Error due to loss of data resulting in a one-minute interval not containing at least 50% of samples of both Reporting ACE and Frequency Error, that one-minute interval is excluded from the calculation of CPS1.

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority uses its own Reporting ACE and Frequency Bias Settings combined with the Reporting ACE and Frequency Bias Settings of the Balancing Authority receiving the Regulation Service to calculate CPS1 performance.

A Balancing Authority receiving Overlap Regulation Service is not subject to CPS1 compliance evaluation.

## Attachment 2

### Equations Supporting Requirement R2 and Measure M2

When Actual Frequency is equal to 60 Hertz,  $BAAL_{High}$  and  $BAAL_{Low}$  do not apply.

When Actual Frequency is less than 60 Hertz,  $BAAL_{High}$  does not apply and  $BAAL_{Low}$  is calculated as:

$$BAAL_{Low} = (-10B_i \times (FTL_{Low} - 60)) \times \frac{(FTL_{Low} - 60)}{(F_A - 60)}$$

When Actual Frequency is greater than 60 Hertz,  $BAAL_{Low}$  does not apply and the  $BAAL_{High}$  is calculated as:

$$BAAL_{High} = (-10B_i \times (FTL_{High} - 60)) \times \frac{(FTL_{High} - 60)}{(F_A - 60)}$$

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 (MW/0.1 Hz)

$F_S$  is the scheduled frequency in hertz for the Interconnection. FS is normally 60 Hz but may be offset to effect manual time error corrections.

$F_A$  is the measured frequency in hertz, to a minimum resolution of plus or minus 0.0005 Hz.

$FTL_{Low}$  is the Low Frequency Trigger Limit (Hz)  $(60-3\epsilon_1)$

$FTL_{High}$  is the High Frequency Trigger Limit (Hz)  $(60+3\epsilon_1)$

Where  $\epsilon_1$  is the constant derived from a targeted frequency bound for each Interconnection as follows:

- Eastern Interconnection  $\epsilon_1 = 0.018$  Hz
- Western Interconnection  $\epsilon_1 = 0.0228$  Hz
- ERCOT Interconnection  $\epsilon_1 = 0.030$  Hz
- Hydro-Quebec Interconnection  $\epsilon_1 = 0.021$  Hz

To ensure that the average Actual Frequency calculated for any one-minute interval is representative of that one-minute interval, at least 50% of the Actual Frequency samples during that one-minute interval must be present. Should a sustained interruption in the recording of Actual Frequency due to loss of data resulting in a one-minute interval without

## **Standard BAL-001-1 – Real Power Balancing Control Performance**

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at least 50% of the samples of Actual Frequency, that one-minute interval is excluded from the data reported for compliance to BAAL.

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority uses its own Frequency Bias Settings combined with the Frequency Bias Settings of the Balancing Authority receiving the Regulation Service to calculate BAAL performance.

A Balancing Authority receiving Overlap Regulation Service is not subject to BAAL compliance evaluation.