

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. This proposed draft standard will be posted for a 30-day formal comment period beginning on December ??, 2011 through January ??, 2012.

Future Development Plan:

Anticipated Actions	Anticipated Date
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_{High}) and a low limit (BAAL_{Low}).

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

4.1.1 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.

4.1.2 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 Regulation Service.

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

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 for each 12 month period, evaluated monthly, to support interconnection frequency. [*Violation Risk Factor: Medium*] [*Time Horizon: Real-time Operations*]~~*Operations Assessment*~~
- R2. Each Balancing Authority shall operate such that its clock-minute average of Reporting ACE does not exceed for more than 30 consecutive clock-minutes 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*]~~*Operations Assessment*~~

C. Measures

- M1. Each Balancing Authority shall provide evidence upon request, such as dated calculation output from spreadsheets, Energy Management 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, Energy Management 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

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 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 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 in digital format at the same scan rate at which the Reporting Ace is calculated 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 Interconnection.	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 Interconnection.	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 Interconnection.	The Balancing Authority Area’s value of CPS1, on a rolling 12-month basis, is less than 85% for the applicable 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
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Standard BAL-001-1 – Real Power Balancing Control Performance

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	
1		Inclusion of BAAL and exclusion of CPS2	Revision

Attachment 1 Equations Supporting Requirement R1 and Measure M1

CPS1 is calculated as follows:

$$\text{CPS1} = (2 - \text{CF}) * 100\%.$$

The frequency-related compliance factor, CF, is a ratio of ~~the accumulating clock~~ all one-minute compliance parameters accumulated over a 12 months period divided by the square of the target frequency bound:

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

where ϵ_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 the most recent consecutive 12 months of data. The accumulating clock-minute compliance parameters are derived ~~basic unit of data comes~~ from the one-minute averages of Reporting ACE, Frequency Error, and Frequency Bias Settings.

Reporting ACE is calculated as follows:

$$\text{Reporting ACE} = (\text{NI}_A - \text{NI}_S) - 10B (F_A - F_S) - \text{NME}$$

Where:

NI_A (Net Interchange Actual) is the algebraic sum of actual megawatt transfers of Megawatts metered across all Tie Lines, and includes Pseudo-Ties. ~~(~~ Balancing Authorities directly connected via asynchronous ties to another Interconnection may include or exclude megawatt transfers on those tie lines in their actual interchange provided they are implemented in the same manner for Net Interchange Schedule. .

NI_S (Net Interchange Schedule) is the algebraic sum of all scheduled megawatt transfers, including Dynamic Schedules, with of Megawatts to or from any adjacent Balancing Authorities, and taking into account ~~incorporating~~ the effects

of schedule ramps ~~ing~~ to Balancing Authorities directly connected via asynchronous ties to another Interconnection may include or exclude megawatt transfers on those tie lines in their scheduled interchange) provided they are implemented in the same manner for Net Interchange Actual.

B (Frequency Bias Setting) 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 units to MW/~~per~~ Hz.

F_A (Actual Frequency) is the measured frequency in hertz, ~~with~~ to a minimum resolution of ~~+/-plus or minus~~ 0.0005 Hz.

F_S (Scheduled Frequency) is 60.0 Hertz, except during a time correction ~~the scheduled frequency in hertz for the Interconnection. F_S is normally 60 Hz but may be offset to effect manual time error corrections.~~

NME (Net Meter Error) is the meter error correction factor and represents ~~based on~~ the difference between the integrated hourly average of the net interchange actual ~~tie line flows~~ (NI_A) and the cumulative hourly net interchange energy measurement (in megawatt-hours).

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.

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

and,

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

The Balancing Authority’s clock-minute compliance factor (CF_{clock-minute}) calculation ~~is~~ 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 factor (CF_{clock-hour}) ~~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 ($CF_{\text{clock-hour average-month}}$) ~~and as well as the data~~ and as well as the data ~~respective number of~~ respective number of samples for each ~~of the~~ of the twenty-four (24) hours period (one for each clock-hour, i.e., hour-ending (HE) 0100, HE 0200, ..., HE 2400). To calculate the monthly compliance factor (CF_{month}):

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

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

To calculate the 12-month compliance factor ($CF_{12\text{ month}}$) 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~~ To ensure that the average Reporting ACE and Frequency Error calculated for any one-minute interval is representative of that ~~time one minute interval, it is necessary that at least 50% of both the Reporting ACE and Frequency Error samples data during the one-minute interval is valid be present. If Should a sustained interruption in the recording of Reporting ACE or Frequency Error is interrupted such that less than due to loss of data resulting in a one minute interval not containing at least 50% of the one-minute sample period data is available or valid, s of both Reporting ACE and Frequency Error, then that a~~ one-minute interval is excluded from the calculation of CPS1 calculation.

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority calculates its CPS1 performance after combining 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 aActual fFrequency is equal to 60 Hertz, $BAAL_{High}$ and $BAAL_{Low}$ do not apply.

When aActual fFrequency 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 aActual fFrequency 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 (expressed as 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, ~~with~~ a minimum resolution of +/- plus or minus 0.0005 Hz.

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

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

Where ϵ_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 aActual fFrequency calculated for any one-minute interval is representative of that ~~time one minute~~ interval, it is necessary that at least 50% of the aActual fFrequency sample datas during that one-minute interval ~~must is valid~~ be present. If ~~Should a sustained interruption in~~ the recording of Aactual Ffrequency is interrupted such

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~~that less than due to loss of data resulting in a one-minute interval without at least 50% of the one-minute sample period data is available or valids of Actual Frequency, then that one-minute interval is excluded from the data reported for compliance to BAAL calculation.~~

A Balancing Authority providing Overlap Regulation Service to another Balancing Authority ~~calculates its BAAL performance after combining 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.