Document Title	WECC Regional Variance to NERC Standard BAL-001-0.1a
File Name	
Category	(X) Regional Reliability Standard ( ) Regional Criterion ( ) Policy ( ) Guideline ( ) Report or other ( ) Charter
Document date	
Adopted/approved by	
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Status	( ) in effect ( ) usable, minor formatting/editing required ( ) modification needed ( ) superseded by _____ ( ) other _____ ( ) obsolete/archived)

Version Control

Version	Date	Action	Change Highlights
1		Version 1 Posted 4/15/11-6/1/11	Addressed FERC Order 723
2		Version 2 Posted 11/4/11	Addressed comments from Version 1 posting
3		Version 3 Posted 12/15/11	Addressed comments from Version 2 posting
4		Standing Committee Approval	
5		WECC Board Approval	

Regional Variance 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:

Completed Actions	Completion Date
1. Request received	09/26/2009
2. Requested deemed Complete/Valid/Team Site created	10/06/2009
3. Pre-SRRC announcement	10/16/2009
4. SRRC notified	10/26/2009
5. SRRC assigned the Request to Standing Committee 6. Due to lack of manpower/resources this Request was placed on hold until July 2010 by Mr. Don Watkins, OC chair	11/2009
7. Assigned to the Performance Work Group by Mr. Hulls, incoming OC chair	07/16/2010
8. Drafting team (DT) announced / notice sent to DT members	07/16/2010
9. Notice of development / first 30-day notice	09/2/2010
10. New committee chair orientation meeting	08/18/2010
11. First DT meeting	11/10/2010
12. Notice of Concurrence sent by DT (see step 3) 13. New meeting announcement / also included in first meeting minutes	11/10/2010
14. DT meetings completed	12/15/10 01/18/11 02/10/11 03/11–12/11 03/24/11 04/11/11
15. Complete first draft and Complete Quality Control Checklist	04/13/2011
16. Post first draft for 45-day comment period	04/15/2011
17. Meeting to answer comments, address impact statement and draft responses	06/2-3/2011 06/14/2011

	06/23/2011 06/29/2011
18. Post responses to comments received during 45-day comment period	06/29/2011
19. Meet to answer to comments, address impact statement and draft responses	08/8/2011 08/15/2011 08/30/2011 11/01/2011
20. Post Version 2 for a 30-day comment period	11/04/2011
21. Post consideration of comments of Version 2	12/15/2011
22. Post Version 3 for 30-day comment period	12/15/2011
23. Project WECC-0068 Version 3 Comments were due	01/16/2012
24. Met to answer to comments, address impact statement, draft responses	01/18/2012
25. Post responses to comments	02/13/2012
26. Post for Operating Committee approval	02/24/2012

Description of Current Draft:

On May 21, 2009, the Federal Energy Regulatory Commission (Commission or FERC) issued a Final Rule approving WECC Regional Reliability Standard BAL-004-WECC-1 – Automatic Time Error Correction (BAL-004-WECC-1) and directing WECC to make several clarifying modifications to the standard using the FERC-approved Process for Developing and Approving WECC Standards.[1] Since the approval of BAL-004-WECC-1 the industry has commented that there is confusion concerning BAL-004-WECC-1 Requirement R3 that requires that the Area Control Error (ACE) equation used for North American Electric Reliability Corporation (NERC) reports shall be the same ACE equation as that used during Automatic Generation Control (AGC) mode. The use of two ACE equations came as a result of NERC's comments in response to the Notice of Proposed Rulemaking regarding the interpretation of NERC Reliability Standard BAL-001-0.1a – Real Power Balancing Control Performance (BAL-001-0.1a) [2] wherein NERC stated that entities may use an Automatic Time Error Correction (ATEC) ACE equation

[1] *Western Electricity Coordinating Council Regional Reliability Standard Regarding Automatic Time Error Correction*, Order No. 723, 127 FERC Stats. & Regs. ¶ 61,176, 74 Fed. Reg. ¶ 25,422 (2009) (hereafter Order 723).

[2] *Modification of Interchange and Transmission Loading Relief Reliability Standards; and Electric Reliability Organization Interpretation of Specific Requirements of Four Reliability Standards*, Notice of Proposed Rulemaking, 123 FERC Stats. & Regs. ¶ 61,064, 73 Fed. Reg. ¶ 22,856 (2008).

for control but should use raw ACE for CPS reporting.[3] The industry desires to use the same ACE equation for control and reporting because it provides better a measurement of control performance.

The purpose of this proposed WECC Regional Variance to BAL-001-01.a (WECC Variance) is to replace Requirements R1 and Section D. Compliance, Subsection 2. of BAL-001-0.1a with three new requirements. In Requirement E.B.1 of the WECC Variance, the drafting team proposes to replace the NERC ACE equation with an ACE equation that includes the ATEC term. Replacing the NERC raw ACE equation with the ATEC ACE equation through a Regional Variance will require Balancing Authorities in the Western Interconnection to use the ATEC ACE for control and CPS reporting purposes. Using the ATEC ACE equation for CPS reporting is more appropriate because, as discussed further below, it is a more accurate measure of how well a Balancing Authority is controlling to its control performance target.

The drafting team for Project WECC-0068 also requests withdrawal of the BAL-001-0.1a Appendix 2 Interpretation of Requirement R1and the BAL-003-0.1b Appendix 1 Interpretation of Requirement R3. By creating a Regional Variance that replaces Requirement R1, these interpretations are no longer needed. The drafting team revised the definition for Area Control Error (ACE) in the WECC Regional Definitions to closely align with NERC definition for ACE while at the same recognizing concept of ATEC.

In order to obtain a Regional Variance[4] to a NERC Reliability Standard, it must be demonstrated that:

- The variance is not inconsistent with or less stringent than the NERC reliability standard;
- Is necessitated by a physical difference; or
- Is an alternative methodology with the same reliability objective.

Replacing the NERC ACE equation with an ATEC ACE equation is an alternative methodology with the same reliability objective as the existing BAL-001-0.1a standard. It is a method of automatically scheduling Primary Inadvertent Interchange (PII) back to other Balancing Authorities. The inclusion of the Automatic Time Error Correction term in the ACE equation changes the Balancing Authority's control performance target. The current NERC ACE equation requires that Balancing Authorities control the frequency and Interchange within their Balancing Authority Area to a target point of zero, but it allows the control to stay within a predefined range called L_{max} which is between 0.20 * |B| and $\pm L_{10}$. The proposed ACE equation, with an Automatic Time Error adjustment, works similarly to the NERC equation; however, the target

[3] *Comments of the North American Electric Reliability Corporation on the Notice of Proposed Rulemaking regarding Interchange and Transmission Loading Relief under RM08-7*, pgs 9-10, FERC Docket No. RM08-7-000, filed June 12, 2008.

[4] "Entity variance" means an aspect of a reliability standard that applies only within a particular entity or a subset of entities within a limited portion of a regional entity, such as a variance that would apply to a regional transmission organization or particular market or to a subset of bulk power system owners, operators or users. An entity variance may not be inconsistent with or less stringent than the reliability standards as it would otherwise exist without the entity variance. An entity variance shall be approved only through the NERC standards development procedure and shall be made part of the NERC reliability standards." (Rules of Procedure of the North American Electric Reliability Corporation, Section 200 — Definition of Terms, page 2.)

point for control is adjusted by the ATEC adjustment. The ATEC component defines a new control point and is equivalent to making an interchange schedule that would automatically payback PII. The modification to the ACE equation is equivalent to making an adjustment because of a metering error. Since the amount of the adjustment during any one hour is limited by L_{max}, Balancing Authorities automatically limit the risk to the interconnection and the amount of the transaction.

The addition of the I_{ATEC} component meets the standard of justification for a Regional Variance as an alternative methodology, with the same reliability objective as the NERC Reliability Standard. In addition, the proposed WECC variance to BAL-001-0.1a is consistent with — or more stringent than — the NERC BAL-001-0.1a Reliability Standard. The reasons the WECC Variance meets the standard of justification are:

1. The addition of I_{ATEC} to the ACE equation and adjustment to the control performance target used for controlling frequency and interchange does not place any addition risk to reliability because limits are set in the magnitude of the I_{ATEC} adjustment.
2. The Regional Variance allows the use of the same control performance target for control and reporting providing a better methodology for measuring performance.
3. It is another control methodology that achieves the same reliability objective as BAL-001-0.1a.

BAL-004-WECC-1 requires Balancing Authorities in the Western Interconnection to use ATEC ACE for control. As proposed in the WECC Variance, Balancing Authorities in the Western Interconnection are required to operate synchronously to the Interconnection, using the ATEC ACE, which automatically corrects time error. The ATEC component in the ACE equation has been effective in mitigating two main issues in the Western Interconnection.

1. It has been used to reduce the number of hours of Manual Time Error Corrections, or the amount of manual adjustments of timing errors that accumulate on clocks, which make certain interconnection scheduled frequency deviations.
2. Since time error is directly related to Inadvertent Interchange, the procedure has been used to reduce accumulated Inadvertent Interchange, or the difference between the actual and scheduled interchange.

The ATEC procedure requires Balancing Authorities in the Western Interconnection to determine their contribution to the Interconnection time error. The Balancing Authority does this by calculating its PII. BAL-001-0.1a Requirement E.B.1 requires that each Balancing Authority calculate its PII_{accum} and I_{ATEC} from its hourly Inadvertent Interchange. When the resulting I_{ATEC} is entered into Balancing Authority's ACE equation, I_{ATEC} continuously corrects for its portion of the time error automatically, as opposed to manually, as specified in the continent-wide standard on Time Error Correction BAL-004-1 Requirement R2. Although the maximum payback is bounded between limits, the continuous correction enables equitable payback of Primary Inadvertent Interchange.

The drafting team is proposing the same Violation Severity Levels for Requirement R1 of the WECC Variance as those in Requirement R1 of BAL-001-01.a because it is a measurement of how well a Balancing Authority is controlling to its control performance target.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Post draft standard for 45-day NERC comment period	02/01/2012
2. NERC comment period ends	03/27/2012
3. Operating Committee approves proposed standard	03/27/2012
4. DT completes review and consideration of industry comments to NERC posting	04/27/2012
5. Post draft standard for WECC Board approval	05/01/2012
6. WECC Board approval	06/21/2012
7. Post draft standard for 15-day NERC comment period	06/25/2012
8. NERC 15-day comment period ends	07/2012
9. DT completes review and consideration of industry comments to NERC posting	07/2012
10. Submit NERC Board of Trustees approval request	08/2012
11. Receive NERC Board approval	08/2012

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Implementation Plan

The proposed Implementation Plan is to make the WECC Regional Variance to BAL-001-0.1a and the proposed WECC Regional Reliability Standard BAL-004-WECC-2 effective on the first day of the second quarter, after regulatory approval. Since entities are already controlling with the ATEC ACE equation, but are using the NERC raw ACE equation for purposes of reporting CPS1, the transition to controlling and reporting using the ATEC ACE should be minimal. Additionally, it should not require much time to implement the limits to a Balancing Authority's Accumulated Primary Inadvertent Interchange.

Definitions of Terms Used in Regional Variance to a NERC 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 definitions will be removed from the standard and added to the NERC Glossary under WECC Regional Definitions.

Area Control Error: The instantaneous difference between a Balancing Authority's net actual and scheduled interchange, taking into account the effects of Frequency Bias, correction for meter error, and Automatic Time Error Correction (ATEC), if operating in the ATEC mode. ATEC is only applicable to Balancing Authorities in the Western Interconnection.

A. Introduction

1. Title: **Real Power Balancing Control Performance**

2. Number: BAL-001-0.1a

3. Purpose: To maintain Interconnection steady-state frequency within defined limits by balancing real power demand and supply in real-time.

4. Applicability:

4.1. Balancing Authorities

5. Effective Date: The WECC Regional Variance to NERC Reliability Standard BAL-001-0.1a is to be effective on the first day of the second quarter, after regulatory approval.

B. Requirements

R1. Each Balancing Authority shall operate such that, on a rolling 12-month basis, the average of the clock-minute averages of the Balancing Authority's Area Control Error (ACE) divided by 10B (B is the clock-minute average of the Balancing Authority Area's Frequency Bias) times the corresponding clock-minute averages of the Interconnection's Frequency Error is less than a specific limit. This limit ε_1^2 is a constant derived from a targeted frequency bound (separately calculated for each Interconnection) that is reviewed and set as necessary by the NERC Operating

$$AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right] \le \in_1^2 \; or \; \frac{AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right]}{\in_1^2} \le 1$$

Committee.

The equation for ACE is:

$ACE = (NI_A - NI_S) - 10B\,(F_A - F_S) - I_{ME}$

where:

- NI_A is the algebraic sum of actual flows on all tie lines.
- NI_S is the algebraic sum of scheduled flows on all tie lines.
- B is the Frequency Bias Setting (MW/0.1 Hz) for the Balancing Authority. The constant factor 10 converts the frequency setting to MW/Hz.
- F_A is the actual frequency.
- F_S is the scheduled frequency. F_S is normally 60 Hz but may be offset to effect manual time error corrections.
- I_{ME} is the meter error correction factor typically estimated from the difference between the integrated hourly average of the net tie line flows (NI_A) and the hourly net interchange demand measurement (megawatt-hour). This term should normally be very small or zero.

R2. Each Balancing Authority shall operate such that its average ACE for at least 90% of clock-ten-minute periods (6 non-overlapping periods per hour) during a calendar

month is within a specific limit, referred to as L_{10}.

$$AVG_{10-\text{minute}}(ACE_i) \le L_{10}$$

where:

$L_{10} = 1.65 \in_{10} \sqrt{(-10B_i)(-10B_s)}$

ε_{10} is a constant derived from the targeted frequency bound. It is the targeted root-mean-square (RMS) value of ten-minute average Frequency Error based on frequency performance over a given year. The bound, ε_{10}, is the same for every Balancing Authority Area within an Interconnection, and B_s is the sum of the Frequency Bias Settings of the Balancing Authority Areas in the respective Interconnection. For Balancing Authority Areas with variable bias, this is equal to the sum of the minimum Frequency Bias Settings.

R3. Each Balancing Authority providing Overlap Regulation Service shall evaluate Requirement R1 (i.e., Control Performance Standard 1 or CPS1) and Requirement R2 (i.e., Control Performance Standard 2 or CPS2) using the characteristics of the combined ACE and combined Frequency Bias Settings.

R4. Any Balancing Authority receiving Overlap Regulation Service shall not have its control performance evaluated (i.e. from a control performance perspective, the Balancing Authority has shifted all control requirements to the Balancing Authority providing Overlap Regulation Service).

C. Measures

M1. Each Balancing Authority shall achieve, as a minimum, Requirement 1 (CPS1) compliance of 100%.

CPS1 is calculated by converting a compliance ratio to a compliance percentage 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 the target frequency bound:

$$CF = \frac{CF_{12-\text{month}}}{(\in_1)^2}$$

where: ε_1 is defined in Requirement R1.

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 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 ACE and for Frequency Error) for each sampling cycle during a given clock-minute.

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

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

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 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).

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

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

The 12-month compliance factor becomes:

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

In order to ensure that the average ACE and Frequency Deviation calculated for any one-minute interval is representative of that one-minute interval, it is necessary that at

least 50% of both ACE and Frequency Deviation samples during that one-minute interval be present. Should a sustained interruption in the recording of ACE or Frequency Deviation due to loss of telemetering or computer unavailability result in a one-minute interval not containing at least 50% of samples of both ACE and Frequency Deviation, that one-minute interval shall be excluded from the calculation of CPS1.

M2. Each Balancing Authority shall achieve, as a minimum, Requirement R2 (CPS2) compliance of 90%. CPS2 relates to a bound on the ten-minute average of ACE. A compliance percentage is calculated as follows:

$$CPS2 = \left[1 - \frac{\text{Violations}_{\text{month}}}{\left(\text{Total Periods}_{\text{month}} - \text{Unavailable Periods}_{\text{month}}\right)}\right] * 100$$

The violations per month are a count of the number of periods that ACE clock-ten-minutes exceeded L_{10}. ACE clock-ten-minutes is the sum of valid ACE samples within a clock-ten-minute period divided by the number of valid samples.

Violation clock-ten-minutes

= 0 if

$$\left|\frac{\sum ACE}{n_{\text{samples in 10-minutes}}}\right| \leq L_{10}$$

= 1 if

$$\left|\frac{\sum ACE}{n_{\text{samples in 10-minutes}}}\right| > L_{10}$$

Each Balancing Authority shall report the total number of violations and unavailable periods for the month. L_{10} is defined in Requirement R2.

Since CPS2 requires that ACE be averaged over a discrete time period, the same factors that limit total periods per month will limit violations per month. The calculation of total periods per month and violations per month, therefore, must be discussed jointly.

A condition may arise which may impact the normal calculation of total periods per month and violations per month. This condition is a sustained interruption in the recording of ACE.

In order to ensure that the average ACE calculated for any ten-minute interval is representative of that ten-minute interval, it is necessary that at least half the ACE data samples are present for that interval. Should half or more of the ACE data be unavailable due to loss of telemetering or computer unavailability, that ten-minute interval shall be omitted from the calculation of CPS2.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

Regional Reliability Organization

1.2. Compliance Monitoring Period and Reset Timeframe

One calendar month.

1.3. Data Retention

The data that supports the calculation of CPS1 and CPS2 (Appendix 1-BAL-001-0) are to be retained in electronic form for at least a one-year period. If the CPS1 and CPS2 data for a Balancing Authority Area are undergoing a review to address a question that has been raised regarding the data, the data are to be saved beyond the normal retention period until the question is formally resolved. Each Balancing Authority shall retain for a rolling 12-month period the values of: one-minute average ACE (ACE_i), one-minute average Frequency Error, and, if using variable bias, one-minute average Frequency Bias.

1.4. Additional Compliance Information

None.

2. Levels of Non-Compliance – CPS1

2.1. Level 1: The Balancing Authority Area's value of CPS1 is less than 100% but greater than or equal to 95%.

2.2. Level 2: The Balancing Authority Area's value of CPS1 is less than 95% but greater than or equal to 90%.

2.3. Level 3: The Balancing Authority Area's value of CPS1 is less than 90% but greater than or equal to 85%.

2.4. Level 4: The Balancing Authority Area's value of CPS1 is less than 85%.

3. Levels of Non-Compliance – CPS2

3.1. Level 1: The Balancing Authority Area's value of CPS2 is less than 90% but greater than or equal to 85%.

3.2. Level 2: The Balancing Authority Area's value of CPS2 is less than 85% but greater than or equal to 80%.

3.3. Level 3: The Balancing Authority Area's value of CPS2 is less than 80% but greater than or equal to 75%.

3.4. Level 4: The Balancing Authority Area's value of CPS2 is less than 75%.

E. Regional Variances

E.A. The ERCOT Control Performance Standard 2 Waiver approved November 21, 2002.

E.B. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Interconnection and replaces, in their entirety, Requirement R1 and Section D.2. (i.e., under Compliance replace Levels of Non-Compliance – CPS1). Please note that the ACE equation is replaced in its entirety with the following equation identified in Requirement E.B.1.

Requirements and Measures

E.B.1. Each Balancing Authority shall operate such that, on a rolling 12-month basis, the average of the clock-minute averages of the Balancing Authority's Area Control Error (ACE) divided by 10B (B is the clock-minute average of the Balancing Authority Area's Frequency Bias) times the corresponding clock-minute averages of the Interconnection's Frequency Error is less than a specific limit. This limit $\in_1^2$ is a constant derived from a targeted frequency bound (separately calculated for each Interconnection) that is reviewed and set as necessary by the NERC Operating Committee.

$$AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right] \le \in_1^2 \; or \; \frac{AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right]}{\in_1^2} \le 1$$

The equation for ACE in the Western Interconnection is:

$$ACE = \left(NI_A - NI_S\right) - 10B\left(F_A - F_S\right) - I_{ME} + I_{ATEC}$$

Where:

NI_A is the algebraic sum of actual flows on all tie lines.

NI_S is the algebraic sum of scheduled flows on all tie lines.

F_A is the actual frequency.

F_S is the scheduled frequency. F_S is normally 60 Hz but may be offset to effect manual time error corrections.

B = Frequency Bias Setting (MW/0.1 Hz) for the Balancing Authority. The constant factor 10 converts the frequency setting to MW/Hz.

I_{ME} is the meter error correction factor typically estimated from the difference between the integrated hourly average of the net tie line flows (NI_A) and the hourly net interchange demand measurement (megawatt-hour). This term should normally be very small or zero.

Rationale for E.B.1

Premise: When a Balancing Authority Area uses the ACE equation with an ATEC correction component for both control and assessing performance, it provides a more accurate measurement of the Control Performance methodology while at the same time achieving the same reliability objective as the existing BAL-001-0.1a standard.

Justification: Adding the ***I_{ATEC}*** term to the ACE equation reduces the number of manual time error corrections and PII_{accum}.

Goal: To establish an ACE equation that permits the implementation of Automatic Time Error Correction.

$I_{ATEC} = \frac{PII_{accum}^{on/off\ peak}}{(1-Y)*H}$ when operating in Automatic Time Error Correction control mode.

I_{ATEC} shall be zero when operating in any other AGC mode.

Y = B / B_S.

H = Number of Hours used to payback Primary Inadvertent Interchange energy. The value of H is set to 3.

B_S = Frequency Bias for the Interconnection (MW / 0.1 Hz).

Primary **I**nadvertent **I**nterchange **(PII_{hourly})** is **$(1-Y) * (II_{actual} - B * \Delta TE/6)$**

II_{actual} is the hourly Inadvertent Interchange for the last hour.

ΔTE is the hourly change in system Time Error as distributed by the Interconnection Time Monitor. Where:

$$\Delta TE = TE_{end\ hour} - TE_{begin\ hour} - TD_{adj} - (t)*(TE_{offset})$$

TD_{adj} is the Reliability Coordinator adjustment for differences with Interconnection Time Monitor control center clocks.

t is the number of minutes of Manual Time Error Correction that occurred during the hour.

TE_{offset} is 0.000 or +0.020 or -0.020.

PII_{accum} is the Balancing Authority's accumulated **PII_{hourly}** in MWh. An On-Peak and Off-Peak accumulation accounting is required.

Where:

$$PII_{accum}^{on/off\ peak} = \text{last period's } PII_{accum}^{on/off\ peak} + PII_{hourly}$$

[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]

M.E.B.1. Each Balancing Authority shall achieve, as a minimum, Requirement E.B.1 (CPS1) compliance of 100%.

CPS1 is calculated by converting a compliance ratio to a compliance percentage 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 the target frequency bound:

$$CF = \frac{CF_{12-month}}{(\in_1)^2}$$

where: $\in_1$ is defined in Requirement E.B.1.

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 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 ACE and for Frequency Error) for each sampling cycle during a given clock-minute.

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

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

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 ACE and of the respective Interconnection's Frequency Error are used to compute the respective hourly average compliance parameter.

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

As part of its evidence each 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).

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

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

The 12-month compliance factor becomes:

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

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

E.B.2. Each Balancing Authority shall limit the absolute value of I_{ATEC}, the Automatic Time Error Correction term as follows: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

$$|I_{ATEC}| \leq L_{max}.$$

Rationale for E.B.2

Premise: I_{ATEC} greater than L_{max} may result in a risk to reliability caused by large ATEC payback.

Justification: Balancing Authorities should not control their Balancing Authority Areas using an approach that puts system reliability at risk.

Goal: The goal of Requirement E.B.2 is to limit I_{ATEC} to L_{max} in order to reduce potential reliability risks to the interconnection caused by a large ATEC payback term.

M.E.B.2. Forms of acceptable evidence for Requirement E.B. 2 may include, but are not limited to:

- Dated Energy Management System (EMS) displays,
- WECC Interchange Tool, EMS application code, or
- Other archived data that demonstrates compliance.

E.B.3. Each Balancing Authority shall set L_{max} within the limits as follows:

$$0.20 * |B| \leq L_{max} \leq L_{10}.$$

[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]

Rationale for E.B.3

Premise: Operating within an L_{max} less than 0.20 * |B| may not provide sufficient correction for PII and operating with an L_{max} greater than L_{10} may result in potential reliability risks caused by a large ATEC payback term.

Justification: L_{max} should be limited to prevent Balancing Authorities from creating potential reliability risks caused by a large ATEC payback term.

Goal: The goal of Requirement E.B.3 is to develop a range for L_{max} where Balancing Authorities reduce potential reliability risks by limiting I_{ATEC} to L_{max}.

M.E.B.3. Forms of acceptable evidence for Requirement E.B. 3 may include, but is not limited to:

- Dated Energy Management System (EMS) displays,
- WECC Interchange Tool, EMS application code, or
- Other archived data that demonstrates compliance.

E.B. Compliance

1. Evidence 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.

Each Balancing Authority in the Western Interconnection shall retain the values of I_{ATEC} and L_{max} for the preceding calendar year (January – December), as well as the current calendar year.

Table of Compliance Elements

E #	Time Horizon	VRF	Violation Severity Levels			
			Lower VSL	Moderate VSL	High VSL	Severe VSL
E.B.1	Real-time Operations	Medium	The Balancing Authority Area's value of CPS1 was less than 100% but greater than or equal to 95%.	The Balancing Authority Area's value of CPS1 was less than 95% but greater than or equal to 90%.	The Balancing Authority Area's value of CPS1 was less than 90% but greater than or equal to 85%.	The Balancing Authority Area's value of CPS1 was less than 85%.
E.B.2	Real-time Operations	Medium	N/A	N/A	N/A	The Balancing Authority Area's absolute value for I_{ATEC} was greater than L_{max}.
E.B.3	Operations Planning	Medium	N/A	N/A	N/A	The Balancing Authority did not set L_{max} to within the limits in E.B.3 (i.e., $0.20 * \|B\| \leq L_{max} \leq L_{10}$).

F. Associated Documents

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	
		WECC Regional Variance Retirement of Appendix 2 Interpretation of Requirement R1	

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CPS1 and CPS2 Data

CPS1 DATA	Description	Retention Requirements
ε_1	A constant derived from the targeted frequency bound. This number is the same for each Balancing Authority Area in the Interconnection.	Retain the value of ε_1 used in CPS1 calculation.
ACE_i	The clock-minute average of ACE.	Retain the 1-minute average values of ACE (525,600 values).
B_i	The Frequency Bias of the Balancing Authority Area.	Retain the value(s) of B_i used in the CPS1 calculation.
F_A	The actual measured frequency.	Retain the 1-minute average frequency values (525,600 values).
F_S	Scheduled frequency for the Interconnection.	Retain the 1-minute average frequency values (525,600 values).

CPS2 DATA	Description	Retention Requirements
V	Number of incidents per hour in which the absolute value of ACE clock-ten-minutes is greater than L_{10}.	Retain the values of V used in CPS2 calculation.
ε_{10}	A constant derived from the frequency bound. It is the same for each Balancing Authority Area within an Interconnection.	Retain the value of ε_{10} used in CPS2 calculation.
B_i	The Frequency Bias of the Balancing Authority Area.	Retain the value of B_i used in the CPS2 calculation.
B_s	The sum of Frequency Bias of the Balancing Authority Areas in the respective Interconnection. For systems with variable bias, this is equal to the sum of the minimum Frequency Bias Setting.	Retain the value of B_s used in the CPS2 calculation. Retain the 1-minute minimum bias value (525,600 values).
U	Number of unavailable ten-minute periods per hour used in calculating CPS2.	Retain the number of 10-minute unavailable periods used in calculating CPS2 for the reporting period.