

Standard Development Timeline

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

Description of Current Draft

This is the final posting of the draft standard for a 10-day final ballot.

Completed Actions	Date
Standards Committee approved SAR for posting	June 10, 2014
SAR Posted for comment	July 16, 2014
Standard posted for 45-day comment period and initial ballot	July 30, 2015
Standard posted for 45-day comment period and successive ballot	November 10, 2015

Anticipated Actions	Date
Final ballot	January – February 2016
NERC Board adoption	February 2016

New or Modified Terms Used in NERC Reliability Standards

This section includes all new or modified terms used in the proposed standard that will be included in the *Glossary of Terms Used in NERC Reliability Standards* upon applicable regulatory approval. Terms used in the proposed standard that are already defined and are not being modified can be found in the *Glossary of Terms Used in NERC Reliability Standards*. The new or revised terms listed below will be presented for approval with the proposed standard.

Term:

Rationale for Modification of AGC: The original definition of AGC reflects "how to" control and automatically adjust equipment in a Balancing Authority Area and does not reflect the current technology nor the evolution of the industry from a "Control Area" to a "Balancing Area". In addition, it was telling the entity "how to do it" rather than allowing the entity to perform the necessary functions in the most effective and reliable manner.

The new definition reflects a process and allows the entity the flexibility to perform the necessary function in the most effective and reliable manner to address such process without being instructed on "how to do it".

Automatic Generation Control (AGC): A process designed and used to automatically adjust a Balancing Authority Areas' Demand and/or resources to help maintain the Reporting ACE in that of a Balancing Authority Area within the bounds required by applicable NERC Reliability Standards.

Actual Frequency (F_A): The Interconnection frequency measured in Hertz (Hz).

Actual Net Interchange (NI_A): The algebraic sum of actual megawatt transfers across all Tie Lines, including Pseudo-Ties, to and from all Adjacent Balancing Authority areas within the same Interconnection. Actual megawatt transfers on asynchronous DC tie lines that are directly connected to another Interconnection are excluded from Actual Net Interchange.

Scheduled Net Interchange (NI_S): The algebraic sum of all scheduled megawatt transfers, including Dynamic Schedules, to and from all Adjacent Balancing Authority areas within the same Interconnection, including the effect of scheduled ramps. Scheduled megawatt transfers on asynchronous DC tie lines directly connected to another Interconnection are excluded from Scheduled Net Interchange.

Interchange Meter Error (I_{ME}): A term, normally zero, used in the Reporting ACE calculation to compensate for data or equipment errors affecting any other components of the Reporting ACE calculation.

Automatic Time Error Correction (I_{A TEC}): The addition of a component to the ACE equation for the Western Interconnection that modifies the control point for the purpose of continuously paying back Primary Inadvertent Interchange to correct accumulated time error. Automatic Time Error Correction is only applicable in the Western Interconnection.

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

The absolute value of I_{A TEC} shall not exceed L_{max}.

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

- L_{max} is the maximum value allowed for I_{A TEC} set by each BA between 0.2*|B_i| and L₁₀,
0.2*|B_i| ≤ L_{max} ≤ L₁₀.
- L₁₀ = 1.65 * ε₁₀ √((-10B_i)(-10B_s)).
- ε₁₀ 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, ε₁₀, is the same for every Balancing Authority Area within an Interconnection.
- Y = B_i / B_s.
- H = Number of hours used to payback primary inadvertent interchange energy. The value of H is set to 3.
- B_i = Frequency Bias Setting for the Balancing Authority Area (MW / 0.1 Hz).
- B_s = Sum of the minimum Frequency Bias Settings for the Interconnection (MW / 0.1 Hz).
- Primary Inadvertent Interchange (PII_{hourly}) is (1-Y) * (I_{actual} - B_i * ΔTE/6)
- I_{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: ΔTE = 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 Area's accumulated PII_{hourly} in MWh. An On-Peak and Off-Peak accumulation accounting is required,
where:

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

Reporting ACE: The scan rate values of a Balancing Authority Area's (BAA) Area Control Error (ACE) measured in MW includes the difference between the Balancing Authority Area's Actual Net Interchange and its Scheduled Net Interchange, plus its Frequency Bias Setting obligation, plus correction for any known meter error. In the Western Interconnection, Reporting ACE includes Automatic Time Error Correction (ATEC).

Reporting ACE is calculated as follows:

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

Reporting ACE is calculated in the Western Interconnection as follows:

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

Where:

- NI_A = Actual Net Interchange.
- NI_S = Scheduled Net Interchange.
- B = Frequency Bias Setting.
- F_A = Actual Frequency.
- F_S = Scheduled Frequency.
- I_{ME} = Interchange Meter Error.
- I_{ATEC} = Automatic Time Error Correction.

All NERC Interconnections operate using the principles of ~~Tie Line~~ Tie-line Bias (TLB) Control and require the use of an ACE equation similar to the Reporting ACE defined above. Any modification(s) to this specified Reporting ACE equation that is(are) implemented for all BAAs on an Interconnection and is(are) consistent with the following four principles of Tie Line Bias control will provide a valid alternative to this Reporting ACE equation:

1. All portions of the Interconnection are included in exactly one BAA so that the sum of all BAAs' generation, load, and loss is the same as total Interconnection generation, load, and loss;
2. The algebraic sum of all BAAs' Scheduled Net Interchange is equal to zero at all times and the sum of all BAAs' Actual Net Interchange values is equal to zero at all times;
3. The use of a common Scheduled Frequency F_S for all BAAs at all times; and,
4. Excludes metering or computational errors. (The inclusion and use of the I_{ME} term corrects for known metering or computational errors.)

Pseudo-Tie: A time-varying energy transfer that is updated in Real-time and included in the Actual Net Interchange term (NIA) in the same manner as a Tie Line in the affected Balancing Authorities' Reporting ACE equation (or alternate control processes).

Rationale for Modification of Balancing Authority: The SDT has recommended to change the definition of Automatic Generation Control (AGC) and to be consistent, with the change to AGC, the SDT recommends changing the definition of a Balancing Authority. In addition, Project 2015-04 Alignment of Terms SDT brought to our attention of the inconsistent use of "load-interchange-generation" and through the Alignment of Terms project it was recommend a SDT associated with a BAL Standard address the issue. The proposed changes reflects a Balancing Authority.

Balancing Authority: The responsible entity that integrates resource plans ahead of time, maintains Demand and resource balance within a Balancing Authority Area, and supports Interconnection frequency in real time.

When this standard has received ballot approval, the text boxes will be moved to the Supplemental Material Section of the *standard*.

A. Introduction

1. **Title:** Balancing Authority Control
2. **Number:** BAL-005-1
3. **Purpose:** This standard establishes requirements for acquiring data necessary to calculate Reporting Area Control Error (Reporting ACE). The standard also specifies a minimum periodicity, accuracy, and availability requirement for acquisition of the data and for providing the information to the System Operator.
4. **Applicability:**
 - 4.1. **Functional Entities:**
 - 4.1.1. Balancing Authority

Effective Date: See Implementation Plan for BAL-005-1

B. Requirements and Measures

Rationale for Requirement R1: Real-time operation of a Balancing Authority requires real-time information. A sufficient scan rate is key to an Operator's trust in real-time information. Without a sufficient scan rate, an operator may question the accuracy of data during events, which would degrade the operator's ability to maintain reliability.

- R1.** The Balancing Authority shall use a design scan rate of no more than six seconds in acquiring data necessary to calculate Reporting ACE. [*Violation Risk Factor: Medium*] [*Time Horizon: Real-time Operations*]
- M1.** Each Balancing Authority will have dated documentation demonstrating that the data necessary to calculate Reporting ACE was designed to be scanned at a rate of no more than six seconds. Acceptable evidence may include historical data, dated archive files; or data from other databases, spreadsheets, or displays that demonstrate compliance.

Rationale for Requirement R2: The RC is responsible for coordinating the reliability of bulk electric systems for member BA's. When a BA is unable to calculate its ACE for an extended period of time, this information must be communicated to the RC within 15 minutes thereafter so that the RC has sufficient knowledge of system conditions to assess any unintended reliability consequences that may occur on the wide area.

- R2.** A Balancing Authority that is unable to calculate Reporting ACE for more than 30-consecutive minutes shall notify its Reliability Coordinator within 45 minutes of the beginning of the inability to calculate Reporting ACE. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- M2.** Each Balancing Authority will have dated records to show when it was unable to calculate Reporting ACE for more than 30 consecutive minutes and that it notified its Reliability Coordinator within 45 minutes of the beginning of the inability to calculate Reporting ACE. Such evidence may include, but is not limited to, dated voice recordings, operating logs, or other communication documentation.

Rationale for Requirement R3: Frequency is the basic measurement for interconnection health, and a critical component for calculating Reporting ACE. Without sufficient available frequency data the BA operator will lack situational awareness and will be unable to make correct decisions when maintaining reliability.

- R3.** Each Balancing Authority shall use frequency metering equipment for the calculation of Reporting ACE: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- 3.1.** that is available a minimum of 99.95% for each calendar year; and,
 - 3.2.** with a minimum accuracy of 0.001 Hz.
- M3.** The Balancing Authority shall have evidence such as dated documents or other evidence in hard copy or electronic format showing the frequency metering equipment used for the calculation of Reporting ACE had a minimum availability of 99.95% for each calendar year and had a minimum accuracy of 0.001 Hz to demonstrate compliance with Requirement R3.

Rationale for Requirement R4: System operators utilize Reporting ACE as a primary metric to determine operating actions or instructions. When data inputs into the ACE calculation are incorrect, the operator should be made aware through visual display. When an operator questions the validity of data, actions are delayed and the probability of adverse events occurring can increase.

- R4.** The Balancing Authority shall make available to the operator information associated with Reporting ACE including, but not limited to, quality flags indicating missing or invalid data. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

- M4.** Each Balancing Authority Area shall have evidence such as a graphical display or dated alarm log that provides indication of data validity for the real-time Reporting ACE based on both the calculated result and all of the associated inputs therein.

Rationale for Requirement R5: Reporting ACE is an essential measurement of the BA's contribution to the reliability of the Interconnection. Since Reporting ACE is a measure of the BA's reliability performance for BAL-001, and BAL-002, it is critical that Reporting ACE be sufficiently available to assure reliability.

- R5.** Each Balancing Authority's system used to calculate Reporting ACE shall be available a minimum of 99.5% of each calendar year. [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Assessment*]
- M5.** Each Balancing Authority will have dated documentation demonstrating that the system necessary to calculate Reporting ACE has a minimum availability of 99.5% for each calendar year. Acceptable evidence may include historical data, dated archive files; or data from other databases, spreadsheets, or displays that demonstrate compliance.

Rationale for Requirement R6: Reporting ACE is a measure of the BA's reliability performance for BAL-001, and BAL-002. Without a process to address persistent errors in the ACE calculation, the operator can lose trust in the validity of Reporting ACE resulting in delayed or incorrect decisions regarding the reliability of the bulk electric system.

A successful Operating Process must include the ability for hourly accumulated Tie Line MWh values to be agreed-upon between Balancing Authority Areas to aid in the identification errors and assign such errors to the appropriate Balancing Authority Areas for mitigation if necessary.

Instantaneous tie line flows between BAs cannot be effectively compared in real time. Methods to confirm accuracy of instantaneous metering is achieved through other means. The integration of instantaneous metered values is compared with accumulated MWh values to determine the accuracy of (error included in) the instantaneous metering for each BA. This comparison indicates the accuracy (amount of error) for each BA's own instantaneous metering as compared to its own accumulated MWh metering. However, it does not confirm that the accumulated MWh metering for one BA is equivalent to the accumulated MWh metering for the adjacent BA on the same tie line. This can only be confirmed by comparing the accumulated MWh value for one BA to the accumulated MWh value for the adjacent BA. If these two values are the same, any problem with the metering is identified by the difference between the integrated instantaneous MWhs and the accumulated MWh for that BA. However, if there is a difference between the accumulated MWhs between the two adjacent BAs, those BAs must agree upon a

common value to use for that hour for that tie line in order to assign responsibility for managing the error represented by the difference between their accumulated values. If the BAs do not agree upon a value, the difference between the accumulated values will not be included in their error mitigation process and that error will therefore be passed to the interconnection as a frequency control burden.

- R6.** Each Balancing Authority that is within a multiple Balancing Authority Interconnection shall implement an Operating Process to identify and mitigate errors affecting the accuracy of scan rate data used in the calculation of Reporting ACE for each Balancing Authority Area. *[Violation Risk Factor: Medium] [Time Horizon: Same-day Operations]*
- M6.** Each Balancing Authority shall have a current Operating Process meeting the provisions of Requirement R6 and evidence to show that the process was implemented, such as dated communications or incorporation in System Operator task verification.

Rationale for Requirement R7: Reporting ACE is an essential measurement of the BA's contribution to the reliability of the Interconnection. Common source data is critical to calculating Reporting ACE that is consistent between Balancing Authorities. When data sources are not common, confusion can be created between BAs resulting in delayed or incorrect operator action.

The intent of Requirement R7 Part 7.1 is to provide accuracy in the measurement and calculations used in Reporting ACE. It specifies the need for common metering points for instantaneous values for the ~~Tie Line~~Tie-Line megawatt flow values between Balancing Authority Areas. Common data source requirements also apply to instantaneous values for pseudo-ties and dynamic schedules, and can extend to more than two Balancing Authorities that participate in allocating shares of a generation resource in supplementary regulation, for example.

The intent of Requirement R7 Part 7.2 is to enable accuracy in the measurements and calculations used in Reporting ACE. It specifies the need for common metering points for hourly accumulated values for the time synchronized tie line MWh values agreed-upon between Balancing Authority Areas. These time synchronized agreed-upon values are necessary for use in the Operating Process required in R6 to identify and mitigate errors in the ~~scan rates~~scan-rate values used in Reporting ACE.

- R7.** Each Balancing Authority shall ensure that each ~~Tie Line~~Tie-Line, Pseudo-Tie, and Dynamic Schedule with an Adjacent Balancing Authority is equipped with: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

- 7.1. a common source to provide information to both Balancing Authorities for the scan rate values used in the calculation of Reporting ACE; and,
 - 7.2. a time synchronized common source to determine hourly megawatt-hour values agreed-upon to aid in the identification and mitigation of errors [under the Operating Process as developed in Requirement R6.](#)
- M7. The Balancing Authority shall have dated evidence such as voice recordings or transcripts, operator logs, electronic communications, or other equivalent evidence that will be used to demonstrate a common source for the components used in the calculation of Reporting ACE with its Adjacent Balancing Authority.

C. 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. Evidence Retention

The following evidence retention period(s) 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 applicable entity shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

- The applicable entity shall keep data or evidence to show compliance for the current year, plus three previous calendar years.

1.3. Compliance Monitoring and Assessment Processes:

As defined in the NERC Rules of Procedure, “Compliance Monitoring and Assessment Processes” refers to the identification of the processes that will be used to evaluate data or information for the purpose of assessing performance or outcomes with the associated Reliability Standard.

1.4. Additional Compliance Information

None

Table of Compliance Elements

R #	Time Horizon	VRF	Violation Severity Levels			
			Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	Real-time Operations	Medium	N/A	N/A	N/A	Balancing Authority was using a design scan rate of greater than six seconds to acquire the data necessary to calculate Reporting ACE.
R2.	Real-time Operations	Medium	The Balancing Authority failed to notify its Reliability Coordinator within 45 minutes of the beginning of a <u>30-minute</u> the inability to calculate Reporting ACE but notified its Reliability Coordinator <u>within no moreless than or equal to</u> 50 minutes from the beginning of the inability to	The Balancing Authority failed to notify its Reliability Coordinator within 50 minutes of the beginning of a <u>30-minute</u> an inability to calculate Reporting ACE but notified its Reliability Coordinator <u>within no moreless than or equal to</u> 55 minutes from the beginning of an inability to	The Balancing Authority failed to notify its Reliability Coordinator within 55 minutes of the beginning of a <u>30-minute</u> an inability to calculate Reporting ACE but notified its Reliability Coordinator <u>within no moreless than or equal to</u> 60 minutes from the beginning of an inability to	The Balancing Authority failed to notify its Reliability Coordinator within 60 minutes of the beginning of a <u>30-minute</u> an inability to calculate Reporting ACE.

			calculate Reporting ACE.	calculate Reporting ACE.	calculate Reporting ACE.	
R3.	Real-time Operations	Medium	The Balancing Authority’s frequency metering equipment used for the calculation of Reporting ACE was available less than 99.95% of the calendar year but was available greater than or equal to 99.94 % of the calendar year.	The Balancing Authority’s frequency metering equipment used for the calculation of Reporting ACE was available less than 99.94% of the calendar year but was available greater than or equal to 99.93 % of the calendar year.	The Balancing Authority’s frequency metering equipment used for the calculation of Reporting ACE was available less than 99.93% of the calendar year but was available greater than or equal to 99.92 % of the calendar year.	The Balancing Authority’s frequency metering equipment used for the calculation of Reporting ACE was available less than 99.92% of the calendar year Or The Balancing Authority’s frequency metering equipment used for the calculation of Reporting ACE failed to have a minimum accuracy of 0.001 Hz.
R4.	Real-time Operations	Medium	N/A	N/A	N/A	The Balancing Authority failed to make available information indicating missing or invalid data associated with

						Reporting ACE to its operators.
R5.	Operations Assessment	Medium	The Balancing Authority’s system used for the calculation of Reporting ACE was available less than 99.5% of the calendar year but was available greater than or equal to 99.4 % of the calendar year.	The Balancing Authority’s system used for the calculation of Reporting ACE was available less than 99.4% of the calendar year but was available greater than or equal to 99.3 % of the calendar year.	The Balancing Authority’s system used for the calculation of Reporting ACE was available less than 99.3% of the calendar year but was available greater than or equal to 99.2 % of the calendar year.	The Balancing Authority’s system used for the calculation of Reporting ACE was available less than 99.2% of the calendar year.
R6.	Same-day Operations	Medium	N/A	N/A	N/A	The Balancing Authority failed to implement an Operating Process to identify and mitigate errors affecting the <u>scan rates</u> scan-rate accuracy of data used in the calculation of Reporting ACE.
R7.	Operations Planning	Medium	N/A	N/A	N/A	The Balancing Authority failed to use a common source for <u>Tie Lines</u> Tie-Lines , Pseudo-ties and

						<p>Dynamic Schedules with its Adjacent Balancing Authorities</p> <p>Or</p> <p>The Balancing Authority failed to use a time synchronized common source for hourly megawatt hour values that are agreed-upon to aid in the identification and mitigation of errors.</p>
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D. Regional Variances

None.

E. Interpretations

None.

F. Associated Documents

None.

Version History

Version	Date	Action	Change Tracking
0	February 8, 2005	Adopted by NERC Board of Trustees	New
0	April 1, 2005	Effective Date	New
0	August 8, 2005	Removed “Proposed” from Effective Date	Errata
0a	December 19, 2007	Added Appendix 1 – Interpretation of R17 approved by BOT on May 2, 2007	Addition
0a	January 16, 2008	Section F: added “1.”; changed hyphen to “en dash.” Changed font style for “Appendix 1” to Arial	Errata
0b	February 12, 2008	Replaced Appendix 1 – Interpretation of R17 approved by BOT on February 12, 2008 (BOT approved retirement of Interpretation included in BAL-005-0a)	Replacement
0.1b	October 29, 2008	BOT approved errata changes; updated version number to “0.1b”	Errata
0.1b	May 13, 2009	FERC approved – Updated Effective Date	Addition
0.2b	March 8, 2012	Errata adopted by Standards Committee; (replaced Appendix 1 with the FERC-approved revised interpretation of R17 and corrected standard version referenced in Interpretation by changing from “BAL-005-1” to “BAL-005-0)	Errata
0.2b	September 13, 2012	FERC approved – Updated Effective Date	Addition

0.2b	February 7, 2013	R2 and associated elements approved by NERC Board of Trustees for retirement as part of the Paragraph 81 project (Project 2013-02) pending applicable regulatory approval.	
0.2b	November 21, 2013	R2 and associated elements approved by FERC for retirement as part of the Paragraph 81 project (Project 2013-02) effective January 21, 2014.	

Standards Attachments

NOTE: Use this section for attachments or other documents that are referenced in the standard as part of the requirements. These should appear after the end of the standard template and before the Supplemental Material. If there are none, delete this section.

Supplemental Material

[Application Guidelines, Guidelines and Technical Basis, Training Material, Reference Material and/or other Supplemental Material]

Rationale

Upon Board approval, the text from the rationale boxes will be moved to this section.