

A. Introduction

1. **Title:** ~~Automatic Generation~~ Balancing Authority Control _____
2. **Number:** BAL-005-~~0.2b~~1
3. **Purpose:**— This standard establishes requirements for Balancing Authority Automatic Generation Control (AGC) acquiring data necessary to calculate Reporting Area Control Error (Reporting ACE) and to routinely deploy the Regulating Reserve. The standard also ~~ensures that all facilities~~ specifies a minimum periodicity, accuracy, and availability requirement for acquisition of the data and load electrically synchronized to for providing the Interconnection are included within information to the metered boundary of a Balancing Area so that balancing of resources and demand can be achieved System Operator.
4. **Applicability:**
 - 1.1. ~~Balancing Authorities~~
 - 1.2. ~~Generator Operators~~
 - 1.3. ~~Transmission Operators~~
 - 4.1. **Load Serving Functional Entities:**
 - 4.1.1. Balancing Authority

Effective Date:— ~~May 13, 2009~~ See Implementation Plan for BAL-005-1

B. Requirements

- B. All generation, transmission, and load operating within an Interconnection must be included within the metered boundaries of a Balancing Authority Area.** 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 ~~Each Generator Operator with generation facilities operating in an Interconnection shall ensure that those generation facilities are included within the metered boundaries of a Balancing Authority Area.~~ 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.

~~Each Transmission Operator with transmission facilities operating in an Interconnection shall ensure that those transmission facilities are included within the metered boundaries of a Balancing Authority Area.~~

~~Each Load Serving Entity with load operating in an Interconnection shall ensure that those loads are included within the metered boundaries of a Balancing Authority Area.~~

~~**R1.** Each Balancing Authority shall maintain Regulating Reserve that can be controlled by AGC to meet the Control Performance Standard. (Retirement approved by NERC BOT pending applicable regulatory approval.)~~

~~**R2.** A Balancing Authority providing Regulation Service shall ensure that adequate metering, communications, and control equipment are employed to prevent such service from becoming a Burden on the Interconnection or other Balancing Authority Areas.~~

R2. —A Balancing Authority providing Regulation Service 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 the Host 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.

~~R1,R4.~~ The Balancing Authority for whom it is controlling if it is unable to provide the service, as well as any Intermediate Balancing Authorities 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 A 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.

R1.1.

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 MWs and the accumulated MWh for that BA. However, if there is a difference between the accumulated MWs 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 receiving Regulation Service 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 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 rate values used in Reporting ACE.

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

~~**R3.** a common source to provide replacement Regulation Service should the supplying Balancing Authority no longer be able to provide this service.~~

~~**1.1.7.1.** The Balancing Authority's AGC shall compare total Net Actual Interchange to total Net Scheduled Interchange plus Frequency Bias obligation to determine the Balancing Authority's ACE. Single information to both Balancing Authorities operating asynchronously may employ alternative ACE calculations such as (but not limited to) flat frequency control. If a Balancing Authority is unable to calculate ACE for more than 30 minutes it shall notify its Reliability~~

~~Coordinator~~ 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.

~~R4.—The Balancing Authority shall operate AGC continuously unless~~ have dated evidence such ~~operation adversely impacts the reliability of the Interconnection. If AGC has become inoperative, the Balancing Authority shall use manual control to adjust generation to maintain the Net Scheduled Interchange.~~

~~The Balancing Authority shall ensure~~ as voice recordings or transcripts, operator logs, electronic communications, or other equivalent evidence that data acquisition will be used to demonstrate a common source for and the components used in the calculation of Reporting ACE occur at least every six seconds.

~~R5.—Each Balancing Authority shall provide redundant and independent frequency metering equipment that shall automatically activate upon detection of failure of the primary source. This overall installation shall provide a minimum availability of 99.95%.~~

~~R6.—The Balancing Authority shall include all Interchange Schedules with its Adjacent Balancing Authorities in the calculation of Net Scheduled Interchange for the ACE equation.~~

~~R6.5.—Balancing Authorities with a high voltage direct current (HVDC) link to another Balancing Authority connected asynchronously to their Interconnection may choose to omit the Interchange Schedule related to the HVDC link from the ACE equation if it is modeled as internal generation or load.~~

~~R7.—The Balancing Authority shall include all Dynamic Schedules in the calculation of Net Scheduled Interchange for the ACE equation.~~

~~Balancing Authorities shall include the effect of ramp rates, which shall be identical and agreed to between affected Balancing Authorities, in the Scheduled Interchange values to calculate ACE.~~ Authority

~~R8.—Each Balancing Authority shall include all Tie-Line flows with Adjacent Balancing Authority Areas in the ACE calculation.~~

~~R8.5.—Balancing Authorities that share a tie shall ensure Tie-Line MW metering is telemetered to both control centers, and emanates from a common, agreed-upon source using common primary metering equipment. Balancing Authorities shall ensure that megawatt-hour data is telemetered or reported at the end of each hour.~~

~~R8.6.—Balancing Authorities shall ensure the power flow and ACE signals that are utilized for calculating Balancing Authority performance or that are transmitted for Regulation Service are not filtered prior to transmission, except for the Anti-aliasing Filters of Tie Lines.~~

~~Balancing Authorities shall install common metering equipment where Dynamic Schedules or Pseudo Ties are implemented between two or more Balancing Authorities to deliver the output of Jointly Owned Units or to serve remote load.~~

~~Each Balancing Authority shall perform hourly error checks using Tie Line megawatt-hour meters with common time synchronization to determine the accuracy of its control equipment. The Balancing Authority shall adjust the component (e.g., Tie Line meter) of ACE that is in error (if known) or use the interchange meter error (I_{ME}) term of the ACE equation to compensate for any equipment error until repairs can be made.~~

~~The Balancing Authority shall provide its operating personnel with sufficient instrumentation and data recording equipment to facilitate monitoring of control performance, generation response, and after the fact analysis of area performance. As a minimum, the Balancing Authority shall provide its operating personnel with real-time values for ACE, Interconnection frequency and Net Actual Interchange with each Adjacent Balancing Authority Area.~~

~~R9. The Balancing Authority shall provide adequate and reliable backup power supplies and shall periodically test these supplies at the Balancing Authority’s control center and other critical locations to ensure continuous operation of AGC and vital data recording equipment during loss of the normal power supply.~~

~~R10. The Balancing Authority shall sample data at least at the same periodicity with which ACE is calculated. The Balancing Authority shall flag missing or bad data for operator display and archival purposes. The Balancing Authority shall collect coincident data to the greatest practical extent, i.e., ACE, Interconnection frequency, Net Actual Interchange, and other data shall all be sampled at the same time.~~

~~R11. Each Balancing Authority shall at least annually check and calibrate its time error and frequency devices against a common reference. The Balancing Authority shall adhere to the minimum values for measuring devices as listed below:~~

| Device | Accuracy |
|----------------------------------|-----------------------------|
| Digital frequency transducer | ≤ 0.001 Hz |
| MW, MVAR, and voltage transducer | ≤ 0.25 % of full scale |
| Remote terminal unit | ≤ 0.25 % of full scale |
| Potential transformer | ≤ 0.30 % of full scale |
| Current transformer | ≤ 0.50 % of full scale |

~~C. Measures~~

~~M1, M7. Not specified.~~

C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility Enforcement Authority

~~Balancing Authorities shall be prepared to supply data to NERC in the format defined below:~~

~~1.1.1. Within one week upon request, Balancing Authorities shall provide As defined in the NERC Rules of Procedure, “Compliance Enforcement Authority” means NERC or the Regional Reliability Organization CPS source data Entity in daily CSV files their respective roles of monitoring and enforcing compliance with time stamped one minute averages of: 1) ACE and 2) Frequency Error.~~

~~Within one week upon request, Balancing Authorities shall provide the NERC or the Regional Reliability Organization DCS source data in CSV files with time stamped scan rate values for: 1) ACE and 2) Frequency Error for a time period of two minutes prior to thirty minutes after the identified Disturbance Reliability Standards.~~

~~1.2. Compliance Monitoring Period and Reset Timeframe~~

~~Not specified.~~

~~1.2. Data Evidence Retention~~

~~1.3.1. Each Balancing Authority shall retain its ACE, actual frequency, Scheduled Frequency, Net Actual Interchange, Net Scheduled Interchange, Tie Line meter error correction and Frequency Bias Setting data in digital format at the same scan rate at which the data is collected for at least one year.~~

~~1.3.2. Each Balancing Authority or Reserve Sharing Group shall retain documentation of the magnitude of each Reportable Disturbance as well as the ACE charts and/or samples used to calculate Balancing Authority or Reserve Sharing Group disturbance recovery values. The data shall be retained for one year following the reporting quarter for which the data was recorded.~~

~~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.~~

~~1.3.1.4.~~ Additional Compliance Information

~~Not specified.~~

~~Levels~~ None

Table of ~~Non~~-Compliance Elements

Not specified.

| <u>R_#</u> | <u>Time Horizon</u> | <u>VRF</u> | <u>Violation Severity Levels</u> | | |
|------------|-----------------------------|---------------|--|---|---|
| | | | <u>Lower VSL</u> | <u>Moderate VSL</u> | <u>High VSL</u> |
| <u>R1.</u> | <u>Real-time Operations</u> | <u>Medium</u> | <u>N/A</u> | <u>N/A</u> | <u>N/A</u> |
| <u>R2.</u> | <u>Real-time Operations</u> | <u>Medium</u> | <u>The Balancing Authority failed to notify its Reliability Coordinator within 45 minutes of the beginning of a 30-minute inability to calculate Reporting ACE but notified its Reliability Coordinator within no more than 50 minutes from the beginning of the inability to calculate Reporting ACE.</u> | <u>The Balancing Authority failed to notify its Reliability Coordinator within 50 minutes of the beginning of a 30-minute inability to calculate Reporting ACE but notified its Reliability Coordinator with no more than 55 minutes from the beginning of an inability to calculate Reporting ACE.</u> | <u>The Balancing Authority failed to notify its Reliability Coordinator within 55 minutes of the beginning of a 30-minute inability to calculate Reporting ACE but notified its Reliability Coordinator with no more than 60 minutes from the beginning of an inability to calculate Reporting ACE.</u> |
| <u>R3.</u> | <u>Real-time Operations</u> | <u>Medium</u> | <u>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</u> | <u>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</u> | <u>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</u> |

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| | | | | | |
|------------|------------------------------|---------------|--|--|--|
| | | | <u>was available greater than or equal to 99.94 % of the calendar year.</u> | <u>available greater than or equal to 99.93 % of the calendar year.</u> | <u>was available greater than or equal to 99.92 % of the calendar year.</u> |
| <u>R4.</u> | <u>Real-time Operations</u> | <u>Medium</u> | <u>N/A</u> | <u>N/A</u> | <u>N/A</u> |
| <u>R5.</u> | <u>Operations Assessment</u> | <u>Medium</u> | <u>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.</u> | <u>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.</u> | <u>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.</u> |
| <u>R6.</u> | <u>Same-day Operations</u> | <u>Medium</u> | <u>N/A</u> | <u>N/A</u> | <u>N/A</u> |

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|-------------------|-----------------------------------|----------------------|-------------------|-------------------|-------------------|
| | | | | | |
| <u>R7.</u> | <u>Operations Planning</u> | <u>Medium</u> | <u>N/A</u> | <u>N/A</u> | <u>N/A</u> |

D. Regional ~~Differences~~Variances

None.

E. Interpretations

None~~None identified.~~

E.F. Associated Documents

1. ~~Appendix 1~~ ~~Interpretation of Requirement R17 (February 12, 2008).~~

None.

Version History

| Version | Date | Action | Change |
|---------|------------------|-----------------------------------|--------|
| 0 | February 8, 2005 | Adopted by NERC Board of Trustees | New |
| 0 | April 1, 2005 | Effective Date | New |

Supplemental Material

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|------|--------------------|--|-------------|
| 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.