Alberta Reliability Standard
Power System Stabilizer
VAR-501-WECC-AB-4

A. Introduction

1. Title: Power System Stabilizer

2. Number: VAR-501-WECC-AB-4

3. Purpose: To ensure the **western interconnection** is operated in a coordinated manner under normal and abnormal conditions by establishing the performance criteria for **WECC** power system stabilizers.

4. Applicability:

4.1. Functional Entities:

4.1.1. the **operator** of a **generating unit**, **operator** of an **aggregated facility**, and **operator** of an **energy storage resource** that is part of the **bulk electric system**; and

4.1.2. the **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility,** and **legal owner** of an **energy storage resource** that is part of the **bulk electric system**.

5. Facilities: This **reliability standard** applies to synchronous **generating units**, **aggregated facilities**, and **energy storage resources** that are part of the **bulk electric system** and in **commercial operation**.

6. Effective Date: The later of (i) July 1, 2028, and (ii) the first **day** of the second calendar quarter following **Commission** approval.

B. Requirements and Measures

R1. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must provide to the **ISO**, the **legal owner**'s written **operating procedure** or other document(s) describing those known circumstances during which the **legal owner**'s power system stabilizers will not be providing an active signal to the **automatic voltage regulator** or **voltage regulating system**, within 180 **days** of any of the following events: *[Alberta Risk Rating: Lower] [Time Horizon: Planning Horizon]*

- The effective date of this **reliability standard**;
- The **generating unit**'s, **aggregated facility**'s or **energy storage resource**'s **commercial operation** date; or
- Any changes to the power system stabilizer operating specifications.

M1. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must have documented evidence that it provided the **ISO**, within the time allotted as described in the procedures required under Requirement R1, written **operating procedures** or other document(s) describing those known circumstances during which the **legal owner**'s power system stabilizer(s) will not be providing an active signal to the **automatic voltage regulator**(s) or **voltage regulating system**(s).

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For auditing purposes, because Requirement R1 conditions are intended to be unchanged unless the **ISO** is otherwise notified, the **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** only need to provide the documentation to the **ISO** one time, or whenever the operating specifications change.

For auditing purposes, if a power system stabilizer is in service but is not providing an active signal to the **automatic voltage regulator**(s) or **voltage regulating system**(s) as described in Requirement R1, the disabled period does not count against the Requirement R2 mandate to be in service except as otherwise allowed.

R2. Each **operator** of a **generating unit**, **operator** of an **aggregated facility**, and **operator** of an **energy storage resource** must have its power system stabilizer(s) in service while synchronized, except during any of the following: *[Alberta Risk Rating: Medium] [Time Horizon: Operating Assessment]*

- Component failure;
- Testing of a **system element** affecting or affected by the power system stabilizer;
- Maintenance; or
- As agreed upon by the **operator** of a **generating unit**, **operator** of an **aggregated facility**, or **operator** of an **energy storage resource** and the **ISO**.

A power system stabilizer that is out of service for less than 30 minutes does not create a violation of this Requirement, regardless of cause.

M2. Each **operator** of a **generating unit**, **operator** of an **aggregated facility**, and **operator** of an **energy storage resource** must have documentation of each claimed exception specified in Requirement R2. Documentation may include:

- A written explanation covering the bulleted exception that describes the circumstances of the exception as allowed in Requirement R2; or
- Documented evidence that the **operator** of a **generating unit**, **operator** of an **aggregated facility**, or **operator** of an **energy storage resource** and the **ISO** agreed the power system stabilizer would not be operating during a specified set of circumstances, where the exception is claimed under the last bullet of Requirement R2.

For auditing purposes, the presumption is that the power system stabilizer was in service unless otherwise exempted in Requirement R2. Evidence need only be provided to prove the circumstances during which the power system stabilizer was not in service for periods in excess of 30 minutes.

R3. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must tune its power system stabilizer to meet the following inter-area mode criteria, except as specified in Requirement R3, Part 3.5 below: *[Alberta Risk Rating: Medium] [Time Horizon: Operating Assessment]*

3.1. Power system stabilizer must be set to provide the measured, simulated, or calculated compensated Vt/Vref frequency response of the excitation system and synchronous machine such that the phase angle will not exceed ± 30 degrees through the frequency range from 0.2 Hertz to the lesser of 1.0 Hertz or the highest frequency at which the phase of the Vt/Vref frequency response does not exceed 90 degrees.

3.2. Power system stabilizer output limits must be set to provide at least ±5% of the synchronous machine's nominal terminal voltage.

3.3. Power system stabilizer gain must be set to between 1/3 and 1/2 of maximum practical gain.

3.4. Power system stabilizer washout time constant must be no greater than 30 seconds.

3.5. Units that have an excitation system or power system stabilizer that is incapable of meeting the tuning requirements of Requirement R3 are exempt from Requirement R3 until the **automatic voltage regulator** or **voltage regulating system** is either replaced or retrofitted such that the power system stabilizer becomes capable of meeting the tuning requirements.

M3. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must have documented evidence that its power system stabilizer was tuned to meet the specifications of Requirement R3.

If the exception under Requirement R3, Part 3.5, is claimed, the **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must have documented evidence describing: 1) the conditions that render the power system stabilizer incapable of meeting the tuning requirements, and 2) the date the voltage regulator was last replaced or retrofitted.

R4. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must install and complete start-up testing of a power system stabilizer on its generator within 180 **days** of either of the following events: *[Alberta Risk Rating: Medium] [Time Horizon: Operational Assessment]*

- The **legal owner** connects a **generating unit**, **aggregated facility** or **energy storage resource** to the **bulk electric system**, after achieving **commercial operation**, and after the effective date of this standard; or
- The **legal owner** replaces the **automatic voltage regulator** or **voltage regulating system** on its existing excitation system, after achieving **commercial operation** for its **generating unit, aggregated facility** or **energy storage resource** that is connected to the **bulk electric system**, and after the effective date of this standard.

M4. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must have evidence that it installed and completed start-up testing of a power system stabilizer on its generator within 180 **days** of either of the conditions described in Requirement R4, and when those conditions occur after the effective date of this standard.

The first bullet of Requirement R4 only applies to equipment on its initial (first energization) connection to the **bulk electric system**.

R5. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must repair or replace a power system stabilizer within 24 **months** of that power system stabilizer becoming incapable of meeting the tuning specifications stated in Requirement R3. *[Alberta Risk Rating: Medium] [Time Horizon: Operational Assessment]*

M5. Each **legal owner** of a **generating unit**, **legal owner** of an **aggregated facility**, and **legal owner** of an **energy storage resource** must have evidence that it repaired or replaced its power system stabilizer within 24 **months** of that power system stabilizer becoming incapable of meeting the tuning

specifications of Requirement R3. Evidence may include documentation of the date the power system stabilizer became incapable of meeting the Requirement R3 tuning specifications, and the date the power system stabilizer was returned to service, demonstrating that the span of time between the two events was less than 24 **months**.

C. Compliance

[Intentionally left blank.]

D. Regional Variances

None.

E. Associated Documents

AESO Information Document ID #2019-047, *Power System Stabilizer*, and any amendments made thereto from time to time

Version History

Version	Effective Date	Description of Changes
AB-4	The later of (i) July 1, 2028, and (ii) the first **day** of the second calendar quarter following **Commission** approval	Revised based on WECC VAR-501-WECC-4, approved by FERC letter order, under Docket No. RD17-5-000. The revisions eliminate requirements to count power system stabilizer operating hours; introduce requirements to provide power system stabilizer operating procedures to the ISO; and introduce performance requirements, including power system stabilizer tuning output design criteria and timeframe to repair or replacement of a non-compliant power system stabilizer.
AB-1	2013-10-01	Initial Release.

Guideline and Technical Basis

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