

Information Document

General Operating Practice – Voltage Control

ID #2010-007RS



Information Documents are not authoritative. Information Documents are for information purposes only and are intended to provide guidance. In the event of any discrepancy between an Information Document and any Authoritative Document(s) in effect, the Authoritative Document(s) governs.

1 Purpose

This Information Document relates to the following Authoritative Documents¹:

- VAR-001-AB-4, *Voltage and Reactive Control* (“VAR-001-AB-4”);
- VAR-002-AB-3, *Generator Operation for Maintaining Network Voltage Schedules* (“VAR-002-AB-3”);
- VAR-501-WECC-AB-1, *Power System Stabilizer*;
- VAR-002-WECC-AB-1, *Automatic Voltage Regulators and Voltage Regulating Systems*;
- Section 203.4 of the ISO rules, *Delivery Requirements*;
- Section 301.2 of the ISO rules, *ISO Directives* (“Section 301.2”); and
- Section 304.4 of the ISO rules, *Maintaining Network Voltage*.

This Information Document describes the AESO’s voltage control operating practices. This Information Document is likely of interest to an operator of a transmission facility, legal owner of a generating unit, legal owner of an aggregated generating facility, operator of a generating unit and operator of an aggregated generating facility.

2 Background

The AESO is responsible for the overall reliability of the interconnected electric system, including ensuring that transmission system voltages (which include 500 kV, 240 kV, 144 kV, 138 kV, 72 kV and 69 kV) are maintained within acceptable levels. Operators of transmission facilities, generating units and aggregated generating facilities are responsible for operating facilities connected to the transmission system.

The transmission system must be capable of steady state operation within acceptable voltage ranges during normal and abnormal conditions.

3 Voltage Control Operating Practices of the AESO

This section provides information regarding the AESO’s voltage control operating practices used to maintain transmission system voltage levels within acceptable limits. The system voltage ranges with associated tolerance bands are provided in Voltage Control – Table 1: *Voltage Limits and Operating Ranges and Limits* (“Table 1”), which is available on the AESO’s website.

3.1 General

The AESO’s general voltage control operating practices include:

- (a) The AESO Energy Management System voltage limits that the AESO operates to are based on Table 1. The AESO refers to Table 1, and monitors the AESO real time Voltage Stability Analysis tool in the AESO Energy Management System.
- (b) In the event that the AESO real time Voltage Stability Analysis establishes a more conservative voltage limit for an area than the limit indicated in Table 1, the AESO informs the

¹ “Authoritative Documents” is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities Act* and regulations, and that contain binding legal requirements for either market participants or the AESO, or both. AESO Authoritative Documents include: the ISO rules, the Alberta reliability standards, and the ISO tariff.

- operators of transmission facilities of the more conservative Voltage Stability Analysis limit and operates to the more conservative limit for the area of concern.
- (c) If the Voltage Stability Analysis tool is not functioning, refer to Voltage Control – Table 2: *Fallback Minimum Voltage Limit Table(s)* (“Table 2”) for the identified area, which is available on the AESO’s website. If Table 2 does not provide a minimum fallback voltage limit, the AESO may, if required, perform an assessment to determine whether a temporary minimum voltage limit should be established.
 - (d) The Alberta interconnected electric system operates with sufficient reactive resources within its boundaries to support the voltage for the next contingency (N - 1).
 - (e) Procedures in Section 4.2 and Section 4.3 below are followed to maintain voltage within the established limits.
 - (f) Capacitive and inductive reactive resources are operated to maintain system and interconnection voltages within established limits.
 - (g) When reactive resources are insufficient to maintain voltage within the minimum limits, corrective action is taken including load reduction.
 - (h) Voltage adjustments are coordinated by the AESO.
 - (i) When the AESO issues an instruction or directive to the operator of a generating unit or an aggregated generating facility for reactive support, the AESO references either a voltage level at the point of connection to the transmission system or the reactive power to be achieved by the generators.
 - (j) To reduce the risk of system instability and to be prepared for contingencies, voltage levels should be at the upper end of the desired range during heavy load periods. Refer to Table 1.
 - (k) Instructions or directives for reactive resources are issued to maintain voltage within the voltage limits identified in Table 1. The AESO expects that such instructions or directives will be followed unless an acceptable explanation is provided as to why the directive cannot be followed. Directives are issued using three-part communication.

3.2 Voltages Fall Below the Desired Range

The AESO implements one or more of the following operating practices if voltages fall below the desired range in Table 1:

- (a) Switch capacitor banks “ON” and reactors “OFF” in the area.
- (b) Adjust taps on transformer onload tap-changers.
- (c) Raise bus voltage or adjust reactive output at generating stations including wind aggregated generating facilities.
- (d) Raise Static Var Compensator and sync-condenser set points.
- (e) Consider reconfiguring the transmission system to avoid possible voltage collapse.
- (f) Cancel outages that would contribute to the low voltages.
- (g) Perform a real time assessment to determine if a lower voltage limit is acceptable.
- (h) Consider effective TMR generation that would support area voltage.
- (i) Take other actions as deemed effective by the AESO, including shedding firm load.

3.3 Voltages Rise Above the Desired Range

The AESO implements one or more of the following operating practices when voltages rise above the desired range in Table 1:

- (a) Switch capacitor banks “OFF” and reactors “ON” in the area.
- (b) Lower set points on transformer tap-changers.
- (c) Lower bus voltage or adjust reactive output at generating stations including wind aggregated generating facilities.
- (d) Lower Static Var Compensator or sync-condenser set points.
- (e) Consider switching out lightly loaded lines after confirming by a study that there are no next contingency concerns.
- (f) Take other actions as deemed necessary by the AESO to reduce voltage.

4 Operator Requests

This section provides general information regarding the processes for requests from an operator of a transmission facility, an operator of a generating unit, or an operator of an aggregated generating facility for voltage adjustments.

An operator of a transmission facility may initiate a request to the AESO for a voltage adjustment on its transmission system or an adjacent transmission system. The AESO assesses such requests considering the overall system voltage and immediate or upcoming events of which the AESO is aware. If the AESO does not agree with the need for the adjustment, the AESO provides an explanation to the operator.

Similarly, an operator of a generating unit or aggregated generating facility may initiate a request to the AESO for a voltage adjustment on the generating unit or aggregated generating facility. The AESO assesses such requests considering the overall system voltage and immediate or upcoming events of which the AESO is aware. If the AESO does not agree with the need for the adjustment, the AESO provides an explanation to the operator.

As part of its assessment, the AESO considers whether the generating unit or aggregated generating facility is able to supply dynamic reactive power reserves. Of particular concern to the AESO is whether a generating unit or aggregated generating facility is operating at a limit, as communicated by the operator of the generating unit or aggregated generating facility as part of its request.

5 Concurrent Voltage (Reactive Power) Directives and Real Power Dispatches

There may be instances where the AESO issues a directive for voltage or reactive power adjustments to the operator of a generating unit or an aggregated generating facility and it is only possible to comply with this directive by lowering the real power output of the generating unit or aggregated generating facility.

6 Information on VAR-001-AB-4

6.1 Information on the Requirements

Requirement R1.1 of VAR-001-AB-4 describes a situation where the AESO must provide information upon request. A request is submitted by email at: ARSSubmittals@aeso.ca.

7 Information on VAR-002-AB-3

7.1 Information on the Requirements

Requirement R2.2 of VAR-002-AB-3 requires the operator of a generating unit or the operator of an aggregated generating facility to provide an explanation of why a directive or instruction cannot be

met. Subsection 3 of Section 301.2 of the ISO rules sets out the requirement to comply with a directive received from the AESO, and the exceptions to this requirement.

Requirements R1.5, R1.6, R3, R4, R5 and R6 of VAR-002-AB-3 describe situations where a market participant must notify or provide information to the AESO.

The AESO contact for requirements R3 and R4 is the AESO system controller. AESO system controller contact information can be obtained from the following source:

- (a) AESO First Call 1-888-588-AESO(2376).

The AESO contact for requirements R1.5, R1.6, R5 and R6 is ARSubmittals@aeso.ca.

Send all requests to schedule an outage to outage.scheduling@aeso.ca

7.2 Explanations regarding start-up, shutdown, offline and testing modes

For a generating unit, start-up is considered to have ended when the generating unit is ramped up to its minimum continuously sustainable load and the generating unit is prepared for continuous operation.

For a generating unit, shutdown is considered to begin after the generating unit is ramped down to its minimum continuously sustainable load and the generating unit is prepared to go offline.

For a wind aggregated generating facility, shutdown and start-up modes do not apply.

A generating unit or wind aggregated generating facility is considered to be offline when the generating unit has been electrically disconnected from the power system.

For a description of when a generating unit is considered to be testing, refer to Section 505.3 of the ISO rules, *Coordinating Energization, Commissioning and WECC Testing Activities*, and associated Information Document #2012-012R, *Coordinating Synchronization, Commissioning, WECC Testing, Ancillary Services Testing, or Operational Testing*, for further information.

Revision History

Posting Date	Description of Changes
2018-10-15	Updated to include references to requirements R1.5 and R1.6 in subsection 7.1; and to add AESO contact information for submission of requests to schedule an outage
2016-09-28	Administrative amendments.
2016-04-01	Amendments to Sections 1, 3, 4, 5 and 6. Removal of "Related Authoritative Documents" section and renumbering. Removal of Appendix 1. Revisions to reflect change in version number of VAR-001 and VAR-002.
2014-12-04	Amendments to Sections 1, 4, 4.1, 4.2, 4.3 and 5
2014-10-07	Amendments to Sections 1, 4, 4.1, 4.2 and 4.3. Removing Appendix 1. Re-naming Appendix 2 to Appendix 1.
2014-09-19	Changes to minimum operating limits and desired ranges in Table 1: Voltage Limits and Operating Changes and Limits. Change to Section 1 to remove reference to contact information.
2013-10-01	Initial release