

Alberta Reliability Standard

Voltage and Reactive Control

VAR-001-AB-1a

1. Purpose

The purpose of this **reliability standard** is to ensure that transmission voltage levels, **reactive power** flows, and **reactive power** resources are monitored, controlled, and maintained within limits in real-time to protect equipment and the reliable operation of the **Interconnection**.

2. Applicability

This **reliability standard** applies to:

- (a) the **operator** of a **transmission facility**; and
- (b) the **ISO**

This **reliability standard** does not apply to the **operator** of a **transmission facility** whose **transmission facility** is a radial connection and has no controllable **reactive power** resources.

3. Requirements

R1 The **ISO** must develop and maintain requirements for monitoring and controlling voltage levels and **reactive power** flows within the **transmission system**, including consulting with each **operator** of a **transmission facility** and any **transmission operator** with an **interconnection** in the development of such requirements.

R2 The **ISO** and each **operator** of a **transmission facility** must develop, maintain, and implement procedures, for monitoring and controlling voltage levels and **reactive power** flows within the **transmission system**, including consulting with each other, any adjacent **operator** of a **transmission facility** and any appropriate **transmission operator** with an **interconnection**.

R3 The **ISO** must operate with sufficient **reactive power** resources available within Alberta to protect the voltage levels of the **transmission system** under normal and **contingency** conditions, including consideration of the **transmission system's** share of the **reactive power** requirements of **interconnections**.

R4 The **ISO** must establish exceptions for a **generating unit** or **aggregated generating facility** from complying with **directives** in requirements R5 and R8 which such exceptions are contained in Appendix 1 of this **reliability standard**.

R4.1 The **ISO** must maintain a list of **generating units** and **aggregated generating facilities** in Alberta that are exempt as set out in requirement R4.

R4.2 The **ISO** must notify each **legal owner** of a **generating unit** and **legal owner** of an **aggregated generating facility** when any of its **generating units** or **aggregated generating facilities** are included on the list referred to in requirement R4.1.

R5 The **ISO** must issue **directives** or instructions to the **operator** of a **generating unit** and an **operator** of an **aggregated generating facility** which specify the following:

- (a) voltage level at the **point of connection** between the **transmission system** and a **generating unit** or an **aggregated generating facility**, including those in a power plant or an industrial complex; or
- (b) the **reactive power** to be achieved by the **generating unit**, **aggregated generating facility**,

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power plant or industrial complex.

R6 The **ISO** must monitor the status of all transmission **reactive power** resources, **automatic voltage regulators**, **voltage regulating systems** and **power system stabilizers**.

R7 Each **operator** of a **transmission facility** must monitor the status of all transmission **reactive power** resources, **automatic voltage regulators**, **voltage regulating systems** and **power system stabilizers** within its service territory.

R8 The **ISO**, when notified by the **operator** of a **generating unit** of the loss of **automatic voltage regulator** control, or by the **operator** of an **aggregated generating facility** of the loss of **voltage regulating system** control, must issue a **directive** or instruction to the **operator** to maintain or change either its voltage or **reactive power**.

R9 The **ISO** must be able to regulate transmission voltage and **reactive power** flow by issuing **directives** or instructions to the **operator** of a **transmission facility** to operate the devices necessary to do so.

R10 The **ISO** must maintain voltage limits within the **ISO's** established voltage limits by issuing **directives** or instructions to the **operator** of a **transmission facility**, to the **operator** of a **generating unit** or to the **operator** of an **aggregated generating facility** with respect to the following:

- (a) **reactive power** generation;
- (b) transmission line switching;
- (c) **reactive power** resource switching; and
- (d) if necessary, load shedding.

R11 The **ISO** must plan for sufficient **reactive power** resources to support voltage under first **contingency** conditions.

R11.1 The **ISO** must plan for **reactive power** resources to be available in locations within Alberta so that the resources can be applied effectively and as soon as reasonably possible when a **contingency** occurs pursuant to R12.

R12 The **ISO** must, if an **ISO-established interconnection reliability operating limit** is exceeded or an **ISO-established system operating limit** is exceeded as a result of **reactive power** resource deficiencies, issue **directives** or instructions to correct the exceeded limit.

R13 The **ISO** must, after a review with the **legal owner** of a **generating unit** or the **legal owner** of an **aggregated generating facility** regarding necessary off-load tap changes for the step-up transformer that connects to the **transmission system**, provide documentation to the **legal owner** of a **generating unit** or the **legal owner** of an **aggregated generating facility** specifying the required tap changes, a timeframe for making the changes, and technical justification for these changes.

R14 The **ISO** must, if **reactive power** resource deficiencies occur, issue **directives** or instructions necessary to prevent voltage collapse including **directives** necessary to reduce load.

4. Measures

The following measures correspond to the requirements identified in section 3 of this **reliability standard**. For example, MR1 is the measure for R1.

MR1 Evidence of developing and maintaining requirements as required under requirement R1 exists.

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Evidence may include requirements of the **reliability standards** or **ISO rules**, version history and consultation documentation.

MR2 Evidence of developing, maintaining and implementing procedures as required in requirement R2 exists. Evidence may include dated, in effect procedures including version history, consultation documentation, **operator** logs and data files.

MR3 Evidence of operating as required in requirement R3 exists. Evidence may include studies, historical energy management system data or demonstrating the voltage limits used in **contingency** analysis are consistent with the **ISO's** published voltage limits.

MR4 Evidence of establishing exceptions as required in requirement R4 exists. Evidence is included in Appendix 1.

MR4.1 Evidence of maintaining a list as required in requirement R4.1 exists. Evidence may include a posting of the required list on the AESO website.

MR4.2 Evidence of notifying entities as required in requirement R4.2 exists. Evidence may include email or mail to appropriate recipient that identifies contents submitted.

MR5 Evidence of issuing **directives** or instructions as required in requirement R5 exists. Evidence may include voice recordings or **operator** logs.

MR6 Evidence of monitoring as required in requirement R6 exists. Evidence may include real-time displays, **operator** logs or data files.

MR7 Evidence of monitoring as required in requirement R7 exists. Evidence may include real-time displays, **operator** logs or data files.

MR8 Evidence of issuing a **directive** or instruction as required in requirement R8 exists. Evidence may include voice recordings or **operator** logs.

MR9 Evidence of being able to regulate transmission voltage and **reactive power** flow as required in requirement R9 exists. Evidence may include relevant **ISO** authoritative documents.

MR10 Evidence of maintaining voltage limits as required in requirement R10 exists. Evidence may include voice recordings or **operator** logs.

MR11 Evidence of planning for sufficient **reactive power** resources as required in requirement R11 exists. Evidence may include dated study results or project documentation.

MR11.1 Evidence of planning for **reactive power** resources as required in requirement R11.1 exists. Evidence may include dated study results or project documentation.

MR12 Evidence of issuing **directives** or instructions as required in requirement R12 exists. Evidence may include voice recordings or **operator** logs.

MR13 Evidence of providing documentation as required in requirement R13 exists. Evidence may include dated study results, email or mail to appropriate recipients that identifies contents submitted.

MR14 Evidence of issuing **directives** or instructions as required in requirement R14 exists. Evidence may include voice recordings or **operator** logs.

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5. Appendices

Appendix 1 - *Exceptions*

Revision History

Effective	Description
2013-10-01	

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Appendix 1 - Exceptions

1. Exception Criteria

In order for an **operator** of a **generating unit** or an **operator** of an **aggregated generating facility** to be exempt from complying with a **directive** issued in accordance with requirements R5 and R8 of this **reliability standard**:

- (a) the facility that is the subject of the **directive** must:
 - (i) be a wind **aggregated generating facility**;
 - (ii) not be equipped with a **voltage regulating system**; and
 - (iii) be the subject of an executed *Construction Commitment Agreement* and have completed the **ISO's** approval process for connection to the **transmission system** under the *Technical Requirements for connecting generators (1999)* ; or
- (b) the exceptions set out in section 301.2 of the **ISO rules**, *Directives* must apply.