# VAR-002-AB-4.1

# Generator Operation for Maintaining Network Voltages

# Standard Effective Date: June 24, 2021

## Audit Summary

|  |  |
| --- | --- |
| **Registered Entity:** | [Registered Entity name as it appears in the AESO ARS Registry] |
| **Functional Entity:** | [Functional entities for which the Registered Entity above was registered throughout the audit period] |
| **Audit Period:** | From: [Audit start date or standard effective date, whichever comes later]  To: [Audit end date or standard withdrawal/supersede date, whichever comes first] |
| **Audit:** | [Scheduled (YYYY-QX) or Spot Check YYYY-MM-DD] |
| **Compliance Monitoring Entity:** | Alberta Electric System Operator (AESO) |
| **Suspected Non-Compliance to the standard?** | |  |  | | --- | --- | |  |  | |  | [If **Yes**, list the requirements with suspected contravention findings e.g. R1, R2, R5] | |
| **Date of Completion** | [Use YYYY-MM-DD format] |

## Assessment Commentary

[Information (if any) relevant to audit findings below]

## Findings

R1 [Summary of Findings]

R2 [Summary of Findings]

R3 [Summary of Findings]

R5 [Summary of Findings]

R6 [Summary of Findings]

## Contact Information

| **Audited Entity** | |
| --- | --- |
| **Compliance Primary** | Name:  Title:  Phone:  Email: |
| **Subject Matter Expert** | Name:  Title:  Phone:  Email: |

| **AESO Team** | |
| --- | --- |
| **Lead Auditor** | Name:  Title:  Phone:  Email: |
| **Auditor** | Name:  Title:  Phone:  Email: |
| **Compliance Manager** | Name:  Title:  Phone:  Email: |
| **Standard Owner** | Name:  Title:  Phone:  Email: |

## Applicability

This **reliability standard** applies to:

1. (a) the **legal owner** of a **generating unit** that has a **maximum authorized real power** greater than or equal to 5 MW and where the **generating unit** is:

(i) connected to a switchyard at which **system access service** is provided to:

(A) the **generating unit**; or

(B) an industrial complex of which the **generating unit** is a part; or

* + - * 1. (ii) directly connected to **transmission facilities** within the City of Medicine Hat;

(b) the **operator** of a **generating unit** that has a **maximum authorized real power** greater than or

1. equal to 5 MW and where the **generating unit** is:

(i) connected to a switchyard at which **system access service** is provided to:

(A) the **generating unit**; or

(B) an industrial complex of which the **generating unit** is a part; or

* + - * 1. (ii) directly connected to **transmission facilities** within the City of Medicine Hat;

(c) the **legal owner** of an **aggregated generating facility** that has a **maximum authorized real power** greater than or equal to 5 MW and is:

(i) connected to a switchyard at which **system access service** is provided to:

(A) the **aggregated generating facility**; or

(B) an industrial complex of which the **aggregated generating facility** is a part; or

* + - * 1. (ii) directly connected to **transmission facilities** within the City of Medicine Hat;

1. (d) the **operator** of an **aggregated generating facility** that has a **maximum authorized real power** greater than or equal to 5 MW and is:

(i) connected to a switchyard at which **system access service** is provided to:

(A) the **aggregated generating facility**; or

(B) an industrial complex of which the **aggregated generating facility** is a part; or

* + - * 1. (ii) directly connected to **transmission facilities** within the City of Medicine Hat;
      1. Notwithstanding subsections (c) and (d) above, this **reliability standard** does not apply to the **legal owner** of an **aggregated generating facility** or the **operator** of an **aggregated generating facility** that meets the criteria listed in Appendix 1 of VAR-001-AB.

## Compliance Assessment

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R1** The **operator** of a **generating unit** and **operator** of an **aggregated generating facility** must, while a **generating unit** or **aggregated generating facility** is electrically connected to the **transmission system**, operate the **generating unit** or **aggregated generating facility** with its **automatic voltage regulator** or **voltage regulating system** in service and in automatic voltage control mode, or in a different control mode as instructed by the **ISO** unless:   1. the **generating unit** or **aggregated generating facility** is exempted by the **ISO**; 2. the **operator** of a **generating unit** or **operator** of an **aggregated generating facility** has notified the **ISO** in accordance with requirement R3 that the **generating unit** or **aggregated generating facility** is not being operated in automatic voltage control mode or in the control mode that was instructed by the **ISO** for a reason other than start-up, shutdown, or testing. Such reasons may include a forced or unplanned change in control mode; 3. the **generating unit** or **aggregated generating facility** is being operated during start-up or shut-down in accordance with the procedure of the **operator** of a **generating unit** or **operator** of an **aggregated generating facility**; or 4. the **operator** of a **generating unit** or the **operator** of an **aggregated generating facility** has previously obtained approval from the **ISO** allowing the **generating unit** or **aggregated generating facility** to be in a testing mode.   **MR1** Evidence of operating the **generating unit** or **aggregated generating facility** in automatic voltage control mode as required in requirement R1 exists. Evidence may include exemption letters, data files, start-up or shut-down procedures, **operator** logs, voice recordings, e-mail, or other equivalent evidence. | AR1 Please provide:   1. Evidence of exemption by the ISO if the facility meets the criteria listed in Appendix 1 of VAR-001-AB; | [Click and edit to enter description for AR1(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(i) evidence to determine whether exemptions exist for any facility this standard applies to. | *For AESO use only* |
| 1. Evidence that the ISO had issued an instruction for the automatic voltage regulator (AVR) or voltage regulating system (VRS) to be in a different control mode during the audit period; | [Click and edit to enter description for AR1(ii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(ii) evidence to determine which mode the AVR or VRS was instructed by the ISO to be in during the audit period, if any. | *For AESO use only* |
| 1. A list of all occurrences (including date, time, duration and reason), except during start-ups and shut-downs, where the AVR and/or VRS was:   (a) not in service; or  (b) not in either voltage control mode or the control mode instructed by the ISO while the generating unit or aggregated generating facility was electrically connected to the transmission system;  If no such occurrences existed during the audit period, provide an attestation letter to this effect. | [Click and edit to enter description for AR1(iii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(iii) list. | *For AESO use only* |
| 1. Evidence of notification (including the date and time) to the ISO for any instance where the generating unit or aggregated generating facility was not being operated in automatic voltage control mode or in the control mode that was instructed by the ISO;   This evidence may include voice recordings, e-mail, operator logs, etc. supporting that a notification to the ISO was made; | [Click and edit to enter description for AR1(iv) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(iv) evidence to determine whether the entity provided notification to the ISO that the generating unit or aggregated generating facility was not being operated in automatic voltage control mode or in the control mode that was instructed by the ISO. | *For AESO use only* |
| 1. Operating procedures (e.g. start-up and/or shut-down procedure, etc.) showing that AVR or VRS is to be (a) in service and (b) in voltage control mode or (c) a different control mode as instructed by the ISO while the generating unit or the aggregated generating facility is electrically connected to the transmission system; | [Click and edit to enter description for AR1(v) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(v) provided operating procedures to determine whether provisions for maintaining the AVR or VRS in service and in voltage control mode while the generating unit or the aggregated generating facility is electrically connected to the transmission system exist. | *For AESO use only* |
| 1. Evidence of having obtained approval from the ISO for testing for any applicable AR(iii) listed instances (if any); | [Click and edit to enter description for AR1(vi) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(vi) evidence to determine whether the ISO approval existed for any instances when the generating unit or aggregated generating facility was in testing mode. | *For AESO use only* |
| 1. AVR/VRS status data during the audit period, samples will be requested by the AESO audit team; | [Click and edit to enter description for AR1(vii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the requested sampled data to determine whether the AVR/VRS were in service and in voltage control mode. | *For AESO use only* |
| or any other evidence to demonstrate compliance with R1. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R2** Unless exempted by the **ISO**, each **operator** of a **generating unit** and each **operator** of an **aggregated generating facility** must, upon receiving an instruction from the **ISO** regarding voltage levels or **reactive power**, comply with that instruction.  **R2.1** Each **operator** of a **generating unit** and each **operator** of an **aggregated generating facility** must, when:   1. the **automatic voltage regulator** of a **generating unit** or the **voltage regulating system** of an **aggregated generating facility** is out of service; or 2. the **generating unit** does not have an **automatic voltage regulator**, or the **aggregated generating facility** does not have a **voltage regulating system**, use an alternative method to control the generator **reactive power** output to comply with an instruction from the **ISO** regarding voltage levels or **reactive power**.   **R2.2** Notwithstanding requirement R2, where the **operator** of a **generating unit** or the **operator** of an **aggregated generating facility** cannot comply with an instruction to modify voltage, the **operator** of a **generating unit** or the **operator** of an **aggregated generating facility** must provide an explanation for why the instruction cannot be met.  **R2.3** Each **operator** of a **generating unit** and **operator** of an **aggregated generating facility** that does not monitor the voltage or **reactive power** at the location specified in an instruction or **directive** from the **ISO** must have a methodology for converting the voltage or **reactive power** at the location specified by the **ISO**.  **MR2** Evidence of complying with an instruction as required in requirement R2 exists. Evidence may include data files, **operator** logs, or other equivalent evidence.  **MR2.1** Evidence of using an alternative method to control generator **reactive power** output as required in requirement R2.1 exists. Evidence may include data files, **operator** logs, voice recordings, or other equivalent evidence.  **MR2.2** Evidence of providing an explanation to the **ISO**, as required in requirement R2.2 exists. Evidence may include voice recordings, **operator** logs, or other equivalent evidence  **MR2.3** Evidence of having a methodology as required in requirement R2.3 exists. Evidence may include a documented methodology, or other equivalent evidence. | **AR2** Please provide:   1. A list of all instructions regarding voltage levels or reactive power received from the ISO throughout the audit period.   If no such instructions were received from the ISO during the audit period, an attestation letter to this effect; | [Click and edit to enter description for AR2(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR2(i) list or the attestation letter, as appropriate. | *For AESO use only* |
| 1. For each instruction received from the ISO, (a) specify whether the automatic voltage regulator (AVR) of a generating unit or the voltage regulating system (VRS) of an aggregated generating facility was out of service at that time, and (b) provide evidence to that effect; | [Click and edit to enter description for AR2(ii) submitted evidence] | [Click and edit to embed file or link to evidence] | Determine whether there were any events where an instruction was issued while any of the generating units and aggregated generating facilities did not have the AVR or VRS in service.  Determine whether there were any events where an instruction was issued to generating units and aggregated generating facilities that did not have AVR or VRS.  For each R2.1 event determine whether the entity used an alternative method to control the generator reactive output. | *For AESO use only* |
| 1. The list of the generating units not having an AVR and the aggregated generating facility not having a VRS, and evidence to that effect, if an ISO instruction existed for such a facility; | [Click and edit to enter description for AR2(iii) submitted evidence] | [Click and edit to embed file or link to evidence] | *For AESO use only* |
| 1. Evidence of complying, such as data files, operator logs, etc., with the instructions received from the ISO, or | [Click and edit to enter description for AR2(iv) submitted evidence] | [Click and edit to embed file or link to evidence] | For each AR2(i) instruction, review the AR2(iv) evidence to determine whether the entity complied with the instruction. | *For AESO use only* |
| 1. Evidence that the ISO granted an exemption from specific instructions (if any); | [Click and edit to enter description for AR2(v) submitted evidence] | [Click and edit to embed file or link to evidence] | For each occurrence listed at AR2(v), review the AR2(vi) evidence to determine whether an appropriate explanation was provided. | *For AESO use only* |
| 1. The list of all instructions that the entity could not comply with (if any); | [Click and edit to enter description for AR2(vi) submitted evidence] | [Click and edit to embed file or link to evidence] | *For AESO use only* |
| 1. Evidence that an explanation of why the instruction cannot be met was provided to the ISO; | [Click and edit to enter description for AR2(vii) submitted evidence] | [Click and edit to embed file or link to evidence] | *For AESO use only* |
| 1. The list of facilities where the location specified in the ISO instruction was not the location the entity monitors the voltage or reactive power at; | [Click and edit to enter description for AR2(viii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR2(vii) and AR2(viii) evidence to determine whether the entity has a methodology to convert the voltage or reactive power at the ISO specified locations, if different than where the voltage or reactive power are monitored. | *For AESO use only* |
| 1. Evidence of having a methodology for converting the voltage or reactive power at the location specified in the ISO instruction; | [Click and edit to enter description for AR2(ix) submitted evidence] | [Click and edit to embed file or link to evidence] | *For AESO use only* |
| or any other evidence to demonstrate compliance with R2. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R3** Each **operator** of a **generating unit** and **operator** of an **aggregated generating facility** must notify the **ISO** within 30 minutes after a status or control mode change of the **automatic voltage regulator**, **voltage regulating system**, alternative voltage controlling device or power system stabilizer, as applicable, on any **generating unit** or **aggregated generating facility**.  **R3.1** If the status or control mode has been restored within 30 minutes of such change, then the **operator** of a **generating unit** or **operator** of an **aggregated generating facility** is not required to notify the **ISO** of the status or control mode change.  **R3.2** If a **generating unit** or an **aggregated generating facility** is in testing, start-up, shut-down or offline mode, requirement R3 does not apply.  **R3.3** If a **generating unit** or an **aggregated generating facility** is operating below the safe and stable level for power system stabilizer operation, then the **operator** of a **generating unit** or **operator** of an **aggregated generating facility** is not required to notify the **ISO** of a change in status of the power system stabilizer caused by the low output level of the **generating unit** or **aggregated generating facility**.  **MR3** Evidence of notifying the **ISO** within 30 minutes of any status or control mode change as required in requirement R3 exists. Evidence may include data logs, SCADA logs, voice recordings, **operator** logs, or other equivalent evidence. | **AR3** Please provide:   1. Evidence, such as data logs, SCADA logs/data, voice recordings, operator logs, etc., that the ISO was notified after each applicable status or control mode change, including the date and time of the notification;   If no such change occurred during the audit period, an attestation letter to this effect; | [Click and edit to enter description for AR3(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR1(iii) provided evidence to determine the applicable occurrences under the requirement R3.  Review the AR3 evidence to determine whether the ISO was notified within thirty (30) minutes after each applicable status or control mode change of the automatic voltage regulator, voltage regulating system or alternative voltage controlling device and power system stabilizer. | *For AESO use only* |
| or any other evidence to demonstrate compliance with R3. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R4** Each **operator** of a **generating unit** and **operator** of an **aggregated generating facility** must notify the **ISO** within 30 minutes after becoming aware of a change in **reactive power** capability due to factors other than a status or control mode change described in requirement R3, or unless:  **R4.1** the capability has been restored within 30 minutes of the **operator** of a **generating unit** or **operator** of an **aggregated generating facility** becoming aware of such change, then the **operator** is not required to notify the **ISO** of the change in **reactive power** capability; or  **R4.2** a **generating unit** or an **aggregated generating facility** is in testing, start-up, shut-down or offline mode, requirement R4 does not apply.  **MR4** Evidence of notifying the **ISO** within 30 minutes of becoming aware of a change in reactive power capability as required in requirement R4 exists. Evidence may include voice recordings, **operator** logs, or other equivalent evidence. | AR4 Please provide:   1. The list of instances when a change in reactive capability (not including the instances pertaining to the requirement R3), including the date and time of becoming aware of each change, a brief description of the cause of the reactive capability change, and the date and time when the reactive capability was restored; or   If no such change occurred during the audit period, an attestation letter to this effect; | [Click and edit to enter description for AR4(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR4(i) evidence for awareness and determine the applicable occurrences under the requirement R4. | *For AESO use only* |
| 1. Evidence, such as voice recordings, operator logs, etc., that the ISO was notified for each applicable change as per AR4(i) including the date and time when the entity became aware of the change; | [Click and edit to enter description for AR4(ii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR4(ii) provided evidence to determine whether the **ISO** was notified for each applicable capability change within 30 minutes after the entity becoming aware of a change in reactive capability. | *For AESO use only* |
| or any other evidence to demonstrate compliance with the requirement R4, such as written policies, procedures or protocols describing how the entity responds to a reactive capability change. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R5** Each **legal owner** of a **generating unit** and each **legal owner** of an **aggregated generating facility** whose step-up transformer for connecting to the **transmission system** or auxiliary transformer has primary voltages equal to or greater than the **generating unit** terminal voltage must provide any one or more of the following to the **ISO** within 30 **days** of a request:   1. (a) tap settings; 2. (b) available fixed tap ranges; and 3. (c) impedance data.   **MR5** Evidence of providing the **ISO** with with information on its step-up and auxiliary transformers, as required in requirement R5 exists. Evidence may include dated written or electronic records, or other equivalent evidence. | AR5 Please provide:   1. The ISO requests for R5 specified information, or   If no such request was received during the audit period, an attestation letter to this effect; | [Click and edit to enter description for AR5(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR5(i) information for accuracy. | *For AESO use only* |
| (ii) Evidence showing the provision of information to the ISO, such as email or mail identifying the information per requirement R5, including the date of provision; | [Click and edit to enter description for AR5(ii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR5(ii) evidence to determine whether the audited entity provided the ISO with the information specified in the requirement R5 within thirty (30) days of an ISO request. | *For AESO use only* |
| or any other evidence to demonstrate compliance with R3. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

| **Requirement and Measure** | **Evidence Submission** | **Evidence Description** | **Evidence** | **Assessment Approach** | **Auditor Notes** |
| --- | --- | --- | --- | --- | --- |
| **R6** Each **legal owner** of a **generating unit** and each **legal owner** of an **aggregated generating facility** that has a step-up transformer, with off-load taps for connecting to the **transmission system** must, change the tap positions according to the specifications the **ISO** provides.  **R6.1** Each **legal owner of a generating unit** and each **legal owner of an aggregated generating facility** that cannot comply with requirement R6 must notify the **ISO** within 30 **days** of the **ISO** providing the specifications and must include the technical justification along with the notice.  **MR6** Evidence of changing step-up transformer taps in accordance with the **ISO**’s specifications as required in requirement R6 exists. Evidence may include written or electronic records, or other equivalent evidence.  **MR6.1** Evidence of notifying the **ISO** as required in requirement R6.1 exists. Evidence may include written or electronic notifications, or other equivalent evidence. | AR6 Please provide:   1. The list of occurrences where the ISO provided specifications to change the off-load tap position, or   If no such occurrences existed during the audit period, an attestation letter to this effect; | [Click and edit to enter description for AR6(i) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR6(i) provided information for accuracy. | *For AESO use only* |
| 1. Evidence of changes made to the tap positions according to the specifications provided by the ISO for each AR6(i) occurrence, or | [Click and edit to enter description for AR6(ii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR6(ii) evidence and to determine whether the audited entity changed the tap position according to the specifications the ISO provided. | *For AESO use only* |
| 1. If the tap positions could not be changed in accordance to to the specifications provided by the ISO, dated evidence of (a) notification to the ISO and (b) technical justification; | [Click and edit to enter description for AR6(iii) submitted evidence] | [Click and edit to embed file or link to evidence] | Review the AR6(iii) evidence to determine whether the audited entity (a) notified the ISO within thirty (30) days of the ISO providing the specifications, and (b) provided a technical justification along with the notification. | *For AESO use only* |
| or any other evidence to demonstrate compliance with R3. | [Click and edit to enter description for any other submitted evidence] | [Click and edit to embed file or link to evidence] | Review any additional evidence provided, as appropriate. | *For AESO use only* |
| **Findings** | | | | | |
| *For AESO use only* | | | | | |

## General Notes

The AESO developed this Reliability Standard Audit Worksheet (RSAW) to add clarity and consistency to the audit team’s assessment of compliance with this reliability standard, including the approach elected to assess requirements.

Additionally, the RSAW provides a non-exclusive list of examples of the types of evidence a market participant may produce or may be asked to produce to demonstrate compliance with this reliability standard. A market participant’s adherence to the examples contained within this RSAW does not constitute compliance with the reliability standard.

This document is not an AESO authoritative document and revisions to it may be made from time to time by the AESO. Market participants are notified of revisions through the stakeholder update process.

## Notes to File

[For AESO use only: any observations, remarks or action items for future audits]

## Revision History

| **Version** | **Issue Date** | **Description** |
| --- | --- | --- |
| 1.0 | July 9, 2021 | Initial version |
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|  |  |  |