

Cover Sheet

**Technical Justification
Retirement of WECC Regional Reliability Standard
VAR-002-WECC-2
Automatic Voltage Regulators (AVR)**

White Paper
Retirement of WECC Regional Reliability Standard
VAR-002-WECC-2
Automatic Voltage Regulators (AVR)



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W E S T E R N E L E C T R I C I T Y C O O R D I N A T I N G
C O U N C I L

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Automatic Voltage Regulators

Executive Summary

The WECC-0127, VAR-002-WECC-2, Automatic Voltage Regulators Drafting Team (DT) has reviewed NERC Standards, both in effect and those standards that are approved pending regulatory filing, and concluded that the substance of WECC Regional Reliability Standard (RRS)¹ should be retired immediately and in its entirety because:

- The standard does not meet either of the Federal Energy Regulatory Commission's (Commission) criteria for a Regional Reliability Standard.
- The standard falls short of Order 672 requirements for clarity and may obfuscate due process.
- The reliability-related substance is addressed in peripheral NERC Standards (VAR-002-4, Generator Operation for Maintaining Network Voltage Schedules and VAR-001-4.1 Voltage and Reactive Control).
- Proposed retirement of Regional Reliability Standard VAR-002-WECC-2 and requiring the generator operate to comply with VAR-002-4 will have the generator operators providing transmission operators with procedures or other documents in real-time that inform the transmission operator of when an automatic voltage regulator will be out-of-service such as: 1) having the Automatic Voltage Regulator (AVR) in service at all times except during specific circumstances, 2) maintaining AVR to stated criteria, 3) installing and completing start-up testing of an automatic voltage regulator; and 4) repairing or replacing a AVR within a specified time period.
- The retiring of the proposed Regional Reliability Standard VAR-002-WECC-2 and following the requirements of VAR-002-4 improves upon the existing regional Reliability Standard by focusing the in-service requirement on performance of the automatic voltage regulator rather than counting the hours they are online; stating the automatic voltage regulator policies and guidelines into the NERC standard, and reducing administrative requirements with little benefit to reliability.

If the document is retired, the reliability-related substance is still addressed in peripheral NERC Standards.

Overview

The following narrative and crosswalk are offered in support of retiring the entire standard. This document is presented in three segments: 1) presentation in narrative form, 2) a tabular representation

¹ Unless otherwise specified, capitalized terms are those defined in the NERC Glossary of Terms Used in Reliability Standards, the NERC Functional Model, and the NERC Rules of Procedures.

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of the standard and how it is addressed in other NERC standards, and 3) inclusion of the standard proposed for retirement.²

If you have questions on the narrative, the DT encourages you to contact the DT chair, [Mr. David Lemmons](#) at (770) 407-7584, or WECC staff support [Mr. W. Shannon Black](#) at (503) 307-5782.

Development History of VAR-002-WECC-2

WECC filed the original Version Zero of the standard after a “1996 disturbance, which was caused by insufficient supply of reactive power from generators, including automatic voltage regulators that were not operating in voltage control mode. Because of this experience, WECC determined that there should be only very limited circumstances where a generator should remove its unit from [Automatic Voltage Regulation] operation.”³

On June 8, 2007, the Commission approved eight WECC Regional Reliability Standards that apply in the Western Interconnection, including WECC-VAR-STD-002a-1 (Automatic Voltage Regulators) and WECC-VAR-STD-002b-1 (Power System Stabilizer). The Commission subsequently approved revisions to both WECC-VAR-STD-002a-1 and WECC VAR-STD-002b-1, which were re-designated VAR-002-WECC-1 and VAR-501-WECC-1, respectively, in Order No. 751.

On March 15, 2012, the Commission issued an order commonly known as the Find, Fix, and Track (FFT) Order in which Paragraph 81 suggested a review of all standards targeting retirement of redundant or otherwise unneeded requirements (AKA: P81). In response, NERC and WECC identified for retirement VAR-002-WECC-1, Requirement R2. Requirement R2 was retired resulting in VAR-002-WECC-2.

In reviewing VAR-002-WECC-2, the WECC-0127 DT determined that full retirement of the standard would be in order.

Criteria for Acceptance of a Regional Reliability Standard (RRS)

² A developmental roadmap and an implementation plan were included in the originally posted version of this document. They were removed from this document and presented to NERC/FERC as freestanding documents titled “WECC-0127 VAR-002-WECC-2 Request to Retire – Attachment E Project Roadmap” and “WECC-0127 VAR-002-WECC-2 Request to retire – Attachment F Implementation Plan”.

³ Order Approving Regional Reliability Standards for the Western Interconnection and Directing Modifications, Docket No. RR07-11-000, 119 FERC ¶ 61,260, (Issued June 8, 2007), P.114. (hereafter cited as RRS Order.) An “automatic voltage regulator” is a device that continuously monitors the generator terminal voltage and changes the reactive power output as required to maintain (or regulate) the voltage within a pre-determined voltage range. For example, if a load increase causes a decline in system voltages and thereby the terminal voltage of a generator, the automatic voltage regulator will increase the generator’s reactive output to raise the terminal voltage. RRS Order, Fn 86.

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A regional difference from a continent-wide Reliability Standard must either be: (1) more stringent than the continent-wide Reliability Standard, or (2) necessitated by a physical difference in the Bulk-Power System.⁴ VAR-002-WECC-2 fails both tests. Further, because the reliability goal of the RRS is addressed in VAR-002-4 and VAR-001-4.1, VAR-002-WECC-2 can be retired without incurring any negative impact to reliability. Lastly, the language of VAR-002-WECC-2 is so amorphous as to fail the Commission's Order 672 threshold by obfuscating due process.

VAR-002-WECC-2 is less stringent than VAR-002-4⁵

On March 3, 2015, the Commission approved VAR-002-WECC-2 on the premise that it was more stringent than its NERC counterpart, VAR-002-3.⁶ The Commission's conclusion was based on the premise that VAR-002-WECC-2 "requires all synchronous generators to have their voltage regulator in service at all time with only exceptions for specified circumstances ... [whereas] [t]he related NERC Reliability Standard...permits a generator to remove its automatic voltage regulator from service for additional reasons."⁷ Although the Commission's conclusion was accurate, analysis since VAR-002-WECC-2's inception shows that the applicable entity(s) can iteratively layer WECC's exceptions resulting in a standard no more stringent than VAR-002-3.

Further, the analysis shows the practical impact of VAR-002-WECC-2 is that the applicable entity simply ends up counting hours of operation without any mandate to deploy Automatic Voltage Regulation should it not be in service. By contrast, VAR-002-4 requires remediation as well as implementation of alternative operation in the event AVR is not in service. Finally, VAR-002-WECC-2 falls short of the Order 672 criteria in that ambiguous verbiage obfuscates due process.

Compounding Exceptions

At first glance, the WECC standard appears to require AVR operation for 98% of all hours whereas the NERC standard requires AVR operation for 100% of all hours. Although the prima facie argument for retirement is met there, on closer examination, neither standard truly requires operation for a specified

⁴ Rules Concerning Certification of the Electric Reliability Organization; and Procedures for the Establishment, Approval, and Enforcement of Electric Reliability Standards, Order No. 672, FERC Stats. & Regs. 31,204, at P 291, order on reh'g, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006).

⁵ Approval Order, P14.

⁶ Docket No. RD15-1-000, Order Approving Two Regional Reliability Standards, Issued March 3, 2015. Hereafter Approval Order.

⁷ Approval Order P14.

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number of hours; therefore, neither the WECC 98% threshold nor the NERC 100% threshold is greater when practical application is considered.

In VAR-002-WECC-2, the applicable entities are required to have AVR “in service and in automatic voltage control mode 98% of all operating hours”, unless they are permitted not to run under any one of ten possible scenarios. A first glance this limited set of exceptions is more stringent than the broader allowance allowed by VAR-002-4; however, when practical application is considered the limited set of exceptions offered by WECC becomes equal to or greater than the set of exceptions allowed by VAR-002-4. As such, VAR-002-WECC-2 is not more stringent than VAR-002-4 and fails the first test for approval as a Regional Reliability Standard.

A review of all ten scenarios shows that an application of eight of the ten exemptions allows the AVR to be off 100% of the time, like VAR-002-4 (8760 hours per year), in some cases up to two years.

- In R1.1 no AVR is required if a unit only runs 43.8 hours per year.
- In R1.3 no AVR is required if there is “instability due to abnormal system configuration.”
- In R1.5 no AVR is required if there is component failure with an explanation. (Up to two years.)
- In R1.6 no AVR is required if there is component failure with an explanation. (Up to two years.)
- In R1.7 no AVR is required if the unit is not commercially operational.
- In R1.8/9 no AVR is required if the unit is “unavailable.”
- In R10 no AVR is required if there are issues with Load Tap Changer operations.

The 100% exception offered by these eight exemptions is no more stringent than VAR-002-4. Only in exceptions R1.2 and R1.4 is there an objective and quantifiable mandate to run AVR.

Under Requirement R1.2, an entity is arguably required to run for no less than 7912.8 hours annually.⁸ The unit is exempt from operation when performing “maintenance and testing up to a maximum of seven calendar days per calendar quarter.” However, if the 7-day maintenance and testing exemption is used up, depending on the precipitating fact pattern, the AVR might continue to be off due to instability (R1.3 and R1.10), due to component failure for up to two years (R1.4, R1.5, and R1.6), or simply because the unit was unavailable (R1.8 and R1.9). Depending on the precipitating fact pattern, the R1.2 exception could be compounded with many of the other exceptions resulting in no practical mandate to run AVR.

⁸ 8760 hours annual – ((7 calendar days X 24 hours =168 hours) X 4 quarters) = 672 hours exempted)) – (the two percent grace period allowed in the body of Requirement R1 (8760 X .02 = 175.2 hours)) = 7912.8 hours annually.

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In like fashion, under Requirement R1.4, an entity is arguably required to run for no less than 7147.8 hours annually.⁹ The unit is exempt from operation for “60 consecutive days for repair per incident.” However, the additional qualifier “per incident” would allow the clock to reset on day 61 thereby defeating the purpose of the limited window requiring the AVR to be on. Even if the 61-day reset approach was not adopted, arguably the incident could be compounded with any number of the remaining exemptions resulting in a component not running at all (see R1.2 explanation). In short, Requirement R1.4 is no more firm in its mandate to run than the other Requirement R1 exemptions. Thus, it is no more stringent than the allowable exceptions of VAR-002-4. Because it is no more stringent it fails the first prong test for approval as a Regional Reliability Standard and should be retired.

VAR-002-4 carries a similar amorphous exception to running in that Requirement R1 requires the applicable entity to operate its generator in AVR mode: 1) *except when* some other mode is called for by the Transmission Operator, 2) *except when* exempted by the Transmission Operator, or, 3) *except when* the Generator Operator notifies the Transmission Operator that one of a specific number of exceptions has occurred. VAR-002-4’s 100% requirement to run, though prima facie evidence of being more stringent than VAR-002-WECC-2, is further whittled down each time: 1) the generator is being operated in start-up, shutdown, or testing mode, 2) the Transmission Operator exempts the AVR from running, or, 3) the AVR is out-of-service.

In short, like VAR-002-WECC-2, VAR-002-4 contains so many exceptions to the rule that neither the 98% nor the 100% threshold have a concrete numerical meaning. Neither threshold is better than the other. Ultimately, whether a unit is on or off will be completely fact specific under each of the standards. As such, the WECC Regional Reliability Standard is no more stringent than the NERC Standard, fails the Order 672 test, and should not be retained on that premise. Further blurring the line between the 98% and 100% thresholds, the language of VAR-002-WECC-2 is sufficiently ambiguous to either obfuscate due process on the one hand or to create undefined discretionary powers for the applicable entities on the other.

VAR-002-WECC-2 Obfuscates Due Process¹⁰

⁹ 8760 hours annually – (60 days X 24 hours = 1440 hours) – (the two percent grace period allowed in the body of Requirement R1 (8760 X .02 = 175.2 hours)) = 7144.8 hours annually).

¹⁰ The Federal Energy Regulatory Commission (FERC) Order 740, Docket No. RM09-15-000, P23, noted that “in the Western Interconnection a significant number of transmission paths are voltage or frequency stability-limited, in contrast to other regions of the [BES] where transmission paths more often are thermally-limited. Disturbances resulting in a stability-limited transmission path overload, generally, must be responded to in a shorter time frame than a disturbance that results in a thermally-limited transmission path overload. [FERC has also noted] its understanding that this physical difference is one of the reasons for the need for certain provisions of regional Reliability Standards in the Western Interconnection.”

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Per Order 672 at P325, the Regional Reliability Standard should be clear and unambiguous regarding what is required and who is required to comply. Users, owners, and operators of the Bulk-Power System must know what they are required to do to maintain reliability.

No Criteria for Instability

In VAR-002-WECC-2, Requirements R1.3 and R.10 requires no AVR if the AVR exhibits “instability due to abnormal system configuration” (R1.3) or “instability due to operation of a Load Tap Changer” (R1.10). It should be noted that nowhere in the document is there an explanation of what constitutes “instability”. Presumably, the operator decides based on its own criteria. If so, this means the operator has full discretion as to whether the AVR runs or not. Without precise boundaries, the requirement offers no due process on the one hand and immense latitude on the other.

No Criteria for Components

VAR-002-WECC-2, Requirements R1.4, R1.5 and R1.6 require no AVR for up to two years (R1.5 at one year; R1.6 at two years) if a “component” fails. Like R1.3, what constitutes a component is not defined. The NERC Glossary of Terms Used in Reliability Standards adds no definitive insights as there, a component ranges from a generator, transmission line, circuit breaker, switch or electrical element (see Contingency). What is known about the component is that an Element may contain more than one component (see Element), an Interconnection contains many of them, they are part of a System that may include generation, transmission, and distribution “components” (see System), and from R1.6 we know the intended components may include replacing the AVR, limiters, and controls but not necessarily the power source and power bridge. In sum, like R1.3, the requirement is so vague as to obfuscate due process on the one hand and provide the applicable entity with an immense amount of discretion on the other.¹¹

No Criteria for Unavailability

VAR-002-WECC-2, Requirements R1.8 and R1.9 require no AVR if the Transmission Operator directs the Generator Operator to operate the generator, and the AVR is “unavailable.” There is no indication as to who makes that determination or under what circumstances that determination is made. Plainly defined, unavailable means not suitable for use. Without further definition, the operator could use any

¹¹ Per Order 672 at P324, a proposed reliability standard must contain a technically sound method to achieve the goal. VAR-002-WECC-2, exception R1. R1.1 requires no AVR if the unit runs for less than five percent of all hours during any calendar quarter. Of note, the drafting team found no technical support for the five percent threshold leading to the conclusion that it may be arbitrary.

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number of undefined criteria to conclude its equipment was “unavailable.” What constitutes unavailable is so vast that it obfuscates due process and in practice creates in the applicable entity the ability to have AVR off for nearly any reason, so long as the reason is documented and the applicable entity counts the associated hours.

In short, if the applicable entity decides the unit is unstable, unavailable, or that an undefined component is not working well – there is no obligation to run AVR. When compared to the exemptions allowed in VAR-002-4 the analysis shows little if any distinction. Because there is no call for remediation in the event the AVR does not run, the practical result is a standard that counts hours.

Counting Hours vs. Ensuring Reliability

VAR-002-WECC-2 has only one requirement – that the Generator Operators and Transmission Operators have AVR in service and in AVR mode 98% of the time – unless otherwise exempted under any one or more of the ten allowed exemptions. Because compliance with the standard is structured towards documentation, in practice the applicable entity can work at building “up” to the 98% rather than keeping equipment in service 100% of the time. Compliance for the single requirement is to file reports that count hours – nothing more. VAR-002-WECC-2 has no mandate for remediation nor call for alternative means to support reliability if the AVR does not run.

By contrast, VAR-002-4 contains the additional benefit for reliability not otherwise contained in VAR-002-WECC-2. VAR-002-4, Requirement R2.1 requires deployment of an alternate means to meet the reliability goal in the event there is a concern with the AVR; no such deployment is required by the RRS. VAR-002-4, Requirement R2.2 requires the Generator Operator to explain to the Transmission Operator why it cannot comply with a schedule; no such communication is required by the RRS. VAR-002-4, Requirement R2.3 requires an alternative means to meet the requirement goal; the RRS does not. VAR-002-4, Requirement R3-R5 require reciprocal communication of events; the RRS requires no communication. VAR-002-4 requires that step-up transformer tap change(s) take place as needed; the RRS speaks of tap changes by creates no mandate to make the change(s). In each of these requirements, VAR-002-4 exceeds the reliability mandates of VAR-002-WECC-2.

In the event the stringency of the two standards was found to be essentially the same (“Run, except when you don’t.”), the drafting team argues that the scale of stringency should tip in favor of VAR-002-4 because the latter requires remedial action whereas VAR-002-WECC-2 does not.

Physical Difference in the Bulk-Power System

A Regional Reliability Standard may be approved when the standard is needed because of a unique physical difference in the Bulk-Power System. Although the drafting team continues to take note of the

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Western Interconnection’s unique configuration and operational needs, the argument of unique physicality is not applicable to this case.

Covered Elsewhere

Although VAR-002-WECC-2 Requirement R1 requires the Transmission Operator to have AVR in service, VAR-002-4 has no reciprocal requirement for the Transmission Operator; however, the reliability goal is captured in VAR-001-4.1 – Voltage and Reactive Control. There, Requirements R1 and R2 require the Transmission Operator to specify a system voltage schedule (R1), and to schedule sufficient reactive resources to regulate voltage levels under normal and Contingency conditions. To the extent that VAR-001-4.1 requires the Transmission Operator to specify and schedule reactive resources such as AVR, R1 and R2 of VAR-001-4.1 meet the reliability goal of VAR-002-WECC-2 without specifying “how” the task is met (results oriented). Thus, if VAR-002-WECC-2 is retired, the reliability task specific to the Transmission Operator remains intact in VAR-001-4.1. Similarly, VAR-002-4 covers the Generator Operator’s requirements, unless otherwise exempted.

The drafting team noted that VAR-001-4.1 Requirement R3 requires the Transmission Operator to “operate or direct the Real-time operation of devices to regulate transmission voltage and reactive flow as necessary.” Whereas VAR-002-WECC-2 creates a static setting for AVR thereby removing discretion from the operator, VAR-001-4.1 allows the operator to attain the same reliability goal based on all the surrounding circumstances in real-time. For example, although VAR-002-WECC-2 requires synchronous condensers to be in service and set to AVR mode, VAR-001-4.1 R3 and associated schedule-related requirements allow greater flexibility of operation while meeting the same reliability goal. This means that a specific listing of the synchronous condenser need not be retained in VAR-002-WECC-2 because VAR-001-4.1 allows the Transmission Operator to include it as needed in reactive power schedules.

Finally, in examining VAR-001-4.1, the drafting team notes that the obligations of the Transmission Operator are carried in to the Regional Variance.

VAR-001-4.1 contains a WECC Regional Variance that supersedes NERC’s Requirements R4 and R5. When applied, the variance does not allow the Transmission Operator to exempt the Generator Operator from operating its AVR; therefore, any generator not having a functioning AVR is required to work with the Transmission Operator to correct the issue. As such, if VAR-002-WECC-2 is retired the more stringent approach taken in the variance is retained to ensure reliability.

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Section 2: Tabular Crosswalk – Covered Elsewhere

Requirement R1

R1. Generator Operators and Transmission Operators shall have AVR in service and in automatic voltage control mode 98% of all operating hours for synchronous generators or synchronous condensers. Generator Operators and Transmission Operators may exclude hours for R1.1 through R1.10 to achieve the 98% requirement. [Violation Risk Factor: Medium] [Time Horizon: Operations Assessment]

(Exceptions R1.1 through R1.10 are covered below.)

**Analysis Table: Requirement R1
Applicable Entities and Facilities Covered Elsewhere**

WECC Standard	NERC Standards	Narrative
VAR-002-WECC-2 Applicability 4.1 Generator Operators 4.2 Transmission Operators that operate synchronous condensers 4.3 This VAR-002-WECC-2 Standard only applies to synchronous generators and synchronous condensers that are connected to the Bulk Electric System.	VAR-001-4.1 Applicability 4.1 Transmission Operators 4.2 Generator Operators within the Western Interconnection (for the WECC Variance) VAR-002-4 Applicability 4.1 Generator Operator 4.2 Generator Owner	The Applicable Entities of the WECC Standard are addressed in VAR-001-4.1 and VAR-002-4. Whereas VAR-002-WECC-2 specifically identifies generators and synchronous condensers as the applicable facilities, these specific assets need not be called out. Rather, by setting the voltage schedule as a results-oriented goal, the Transmission Operator can allow for an array of assets to deploy without confining the resources to a specific list.

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Analysis Table: Requirement R1			
AVR in Service and Controlling – Covered Elsewhere			
VAR-002-WECC-2	VAR-002-4	VAR-001-4.1	Narrative
Generator Operator and Transmission Operator	Generator Operator	Transmission Operator	
R1. Generator Operators and Transmission Operators shall have AVR in service and in automatic voltage control mode.	R1. The Generator Operator shall operate each generator connected to the interconnected transmission system (with its automatic voltage regulator (AVR) in service) in the automatic voltage control mode.	R1. Each Transmission Operator shall specify a system voltage schedule (which is either a range or a target value with an associated tolerance band) as part of its plan to operate within System Operating Limits and Interconnection Reliability Operating Limits.	The Generator Operator and the Transmission Operator’s reliability tasks are addressed in VAR-002-4 and VAR-001-4.1. and its Regional Variance. By creating the voltage schedule, the Transmission Operator sets the reliability goal to be met without restricting the specific type of resource to be used. Restated, the VAR-01-4.1 approach is inclusive of VAR-002-WECC-2 without specifying “how” the goal is to be met.
		R2. Each Transmission Operator shall schedule sufficient reactive resources to regulate voltage levels under normal and	

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		Contingency conditions. (Various means are allowed.)	
		R3. Each Transmission Operator shall operate or direct the Real-Time operation of device to regulate transmission voltage and reactive flow as necessary.	

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Analysis Table: Requirement R1		
Exceptions to the Rule – Covered Elsewhere		
VAR-002-WECC-2	VAR-002-4	Narrative
General: AVR shall be in service 98% of the time, unless covered by one of ten exceptions.	General: AVR shall be in service 100% of the time, unless covered by an exception.	Because the VAR-002-WECC-2 list of exceptions can be compounded, the practical result is that the specific list of exceptions is not more stringent than the generalized exception offered in VAR-002-4. Thus, VAR-002-WECC-2 is not more stringent than VAR-002-4.
Exceptions: R1.1 through R1.10.	Exceptions: [When] the generator is being operated in start-up, shutdown, or testing mode pursuant to a real-time communication or a procedure that was previously provided to the Transmission Operator; or, (AKA: Start up, shutdown, or testing.) [When] the generator is not being operated in automatic voltage control mode or in the control mode that was instructed by the Transmission Operator for a reason other than start-up, or testing.	

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	(AKA: Other than start up, shutdown, or testing.)	
R1.1 The synchronous generator or synchronous condenser operates for less than five percent of all hours during any calendar quarter.	[R1.1] Other than start up, shutdown, or testing.	
R1.2. Performing maintenance and testing up to a maximum of seven calendar days per calendar quarter.	[R1.2] Start up, shutdown, or testing.	
R1.3. AVR exhibits instability due to abnormal system configuration.	[R1.3] Other than start up, shutdown, or testing.	
R1.4. Due to component failure, the AVR may be out of service up to 60 consecutive days for repair per incident.	[R1.4] Other than start up, shutdown, or testing.	
R1.5. Due to a component failure, the AVR may be out of service up to one year provided the Generator Operator or Transmission Operator submits documentation identifying the need for time to obtain replacement parts and if required to schedule an outage.	[R1.5] Other than start up, shutdown, or testing.	

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<p>R1.6. Due to a component failure, the AVR may be out of service up to 24 months provided the Generator Operator or Transmission Operator submits documentation identifying the need for time for excitation system replacement (replace the AVR, limiters, and controls but not necessarily the power source and power bridge) and to schedule an outage.</p>	<p>[R1.6] Other than start up, shutdown, or testing.</p>	
<p>R1.7. The synchronous generator or synchronous condenser has not achieved Commercial Operation.</p>	<p>[R1.7] Start up, shutdown, or testing.</p>	
<p>R1.8. The Transmission Operator directs the Generator Operator to operate the synchronous generator, and the AVR is unavailable for service.</p>	<p>[R1.8] Other than start up, shutdown, or testing.</p>	
<p>R1.9. The Reliability Coordinator directs Transmission Operator to operate the synchronous condenser, and the AVR is unavailable for service.</p>	<p>[R1.9] Other than start up, shutdown, or testing.</p>	
<p>R1.10. If AVR exhibits instability due to operation of a Load Tap Changer (LTC) transformer in the area, the Transmission Operator may authorize the Generator Operator to operate the</p>	<p>[R1.10] Other than start up, shutdown, or testing.</p>	

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excitation system in modes other than automatic voltage control until the system configuration changes.		
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Section 3: Existing Standard Proposed for Retirement

VAR-002-WECC-2

A. Introduction

- 1. Title:** Automatic Voltage Regulators (AVR)
- 2. Number:** VAR-002-WECC-2
- 3. Purpose:** To ensure that Automatic Voltage Regulators on synchronous generators and condensers shall be kept in service and controlling voltage.
- 4. Applicability**
 - 4.1. Generator Operators
 - 4.2. Transmission Operators that operate synchronous condensers
 - 4.3. This VAR-002-WECC-2 Standard only applies to synchronous generators and synchronous condensers that are connected to the Bulk Electric System.
- 5. Effective Date:** On the first day of the first quarter, after applicable regulatory approval.

B. Requirements

- R1.** Generator Operators and Transmission Operators shall have AVR in service and in automatic voltage control mode 98% of all operating hours for synchronous generators or synchronous condensers. Generator Operators and Transmission Operators may exclude hours for R1.1 through R1.10 to achieve the 98% requirement. *[Violation Risk Factor: Medium] [Time Horizon: Operations Assessment]*
 - R1.1.** The synchronous generator or synchronous condenser operates for less than five percent of all hours during any calendar quarter.
 - R1.2.** Performing maintenance and testing up to a maximum of seven calendar days per calendar quarter.
 - R1.3.** AVR exhibits instability due to abnormal system configuration.
 - R1.4.** Due to component failure, the AVR may be out of service up to 60 consecutive days for repair per incident.
 - R1.5.** Due to a component failure, the AVR may be out of service up to one year provided the Generator Operator or Transmission Operator submits

documentation identifying the need for time to obtain replacement parts and if required to schedule an outage.

- R1.6.** Due to a component failure, the AVR may be out of service up to 24 months provided the Generator Operator or Transmission Operator submits documentation identifying the need for time for excitation system replacement (replace the AVR, limiters, and controls but not necessarily the power source and power bridge) and to schedule an outage.
- R1.7.** The synchronous generator or synchronous condenser has not achieved Commercial Operation.
- R1.8.** The Transmission Operator directs the Generator Operator to operate the synchronous generator, and the AVR is unavailable for service.
- R1.9.** The Reliability Coordinator directs Transmission Operator to operate the synchronous condenser, and the AVR is unavailable for service.
- R1.10.** If AVR exhibits instability due to operation of a Load Tap Changer (LTC) transformer in the area, the Transmission Operator may authorize the Generator Operator to operate the excitation system in modes other than automatic voltage control until the system configuration changes.

C. Measures

- M1.** Generator Operators and Transmission Operators shall provide quarterly reports to the compliance monitor and have evidence for each synchronous generator and synchronous condenser of the following:
 - M1.1** The actual number of hours the synchronous generator or synchronous condenser was on line.
 - M1.2** The actual number of hours the AVR was out of service.
 - M1.3** The AVR in service percentage.
 - M1.4** If excluding AVR out of service hours as allowed in R1.1 through R1.10, provide:
 - M1.4.1** The number of hours excluded,
 - M1.4.2** The adjusted AVR in-service percentage,
 - M1.4.3** The date of the outage.

D. Compliance

1. Compliance Monitoring Process

1.1 Compliance Monitoring Responsibility

Compliance Enforcement Authority

1.2 Compliance Monitoring Period

Compliance Enforcement Authority may use one or more of the following methods to assess compliance:

- Reports submitted quarterly
- Spot check audits conducted anytime with 30 days notice
- Periodic audit as scheduled by the Compliance Enforcement Authority
- Investigations
- Other methods as provided for in the Compliance Monitoring Enforcement Program

The Reset Time Frame shall be a calendar quarter.

1.3 Data Retention

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 for three years plus current year, or since the last audit, whichever is longer.

1.4 Additional Compliance Information

1.4.1 The sanctions shall be assessed on a calendar quarter basis.

1.4.2 If any of R1.2 through R1.9 continues from one quarter to another, the number of days accumulated will be the contiguous calendar days from the beginning of the incident to the end of the incident. For example, in R1.4 if the 60 day repair period goes beyond the end of a quarter, the repair period does not reset at the beginning of the next quarter.

1.4.3 When calculating the in-service percentages, do not include the time the AVR is out of service due to R1.1 through R1.10.

1.4.4 The standard shall be applied on a machine-by-machine basis (a

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Generator Operator or Transmission Operator can be subject to a separate sanction for each non-compliant synchronous generator and synchronous condenser).

E. Regional Differences

None

Table of Compliance Elements

R	Time Horizon	VRF	Violation Severity Levels			
			Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	Operational Assessment	Medium	There shall be a Lower Level of non-compliance if AVR is in service less than 98% but at least 90% or more of all hours during which the synchronous generating unit or synchronous condenser is on line for each calendar quarter.	There shall be a Moderate Level of non-compliance if AVR is in service less than 90% but at least 80% or more of all hours during which the synchronous generating unit or synchronous condenser is on line for each calendar quarter.	There shall be a High Level of non-compliance if AVR is in service less than 80% but at least 70% or more of all hours during which the synchronous generating unit or synchronous condenser is on line for each calendar quarter.	There shall be a Severe Level of non-compliance if AVR is in service less than 70% of all hours during which the synchronous generating unit or synchronous condenser is on line for each calendar quarter.

**Attachment G
Technical Justification**

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Version History

Version	Date	Action	Change Tracking
1	April 16, 2008	Permanent Replacement Standard for VAR-STD-002a-1	
1	April 21, 2011	FERC Order issued approving VAR-002-WECC-1 (FERC approval effective June 27, 2011; Effective Date July 1, 2011)	
2	November 13, 2014	Adopted by NERC Board of Trustees	
2	March 3, 2015	FERC letter order approving VAR-002-WECC-2	