

Mapping Document

Project 2021-02 Modifications to VAR-002-4.1

Standard: VAR-002-5		
Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
VAR-002-4.1, Requirement R1 The Generator Operator shall operate each generator connected to the interconnected transmission system in the automatic voltage	VAR-002-5, Requirement R1 The Generator Operator shall operate each generating resource(s) connected to the interconnected Transmission System in the	Requirement R1 has been maintained due to the importance of Generator Operator running a unit with its automatic voltage regulator (AVR)
control mode (with its automatic voltage regulator (AVR) in service and controlling voltage) or in a different control mode as instructed by the Transmission Operator unless: 1) the generator is exempted by the Transmission Operator, or 2) the	automatic voltage control mode (with its automatic voltage regulator (AVR) in service and controlling voltage) or in a different control mode as instructed by the Transmission Operator unless: 1) generating resource(s) is	in service and in either voltage controlling mode, or the mode instructed by the Transmission Operator. The Project 2021-02 SDT proposed minor changes to bring attention to dispersed power producing resource as
Generator Operator has notified the Transmission Operator of one of the following: [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	exempted by the Transmission Operator, or 2) the Generator Operator has notified the Transmission Operator of one of the following: [Violation Risk Factor: Medium] [Time Horizon:	defined by the Bulk Electric System definition in the NERC Glossary of Terms for inclusion to Generation voltage or Reactive Power control resources and difference in type of voltage
• That the generator is being operated in start- up,1 shutdown,2 or testing mode pursuant to a Real-time communication or a procedure that was previously provided to the Transmission Operator; or	 Real-time Operations] That generating resource(s) 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 	control such as a volt/VAR controller for aggregated Generation system control at the Transmission Point of Interconnection or as stated in the Transmission Operator voltage Reactive Power instruction.
 That the generator is not being operated in automatic voltage control mode or in the control mode that was instructed by the Transmission 	That the generating resource(s) is not being operated in automatic voltage control mode or in the control mode that was instructed by the	



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Operator for a reason other than start-up, shutdown, or testing	Transmission Operator for a reason other than start-up, shutdown, or testing.	
VAR-002-4.1, Measure M1 The Generator Operator shall have evidence to show that it notified its associated Transmission Operator any time it failed to operate a generator in the automatic voltage control mode or in a different control mode as specified in Requirement R1. If a generator is being started up or shut down with the automatic voltage control off, or is being tested, and no notification of the AVR status is made to the Transmission Operator, the Generator Operator will have evidence that it notified the Transmission Operator of its procedure for placing the unit into automatic voltage control mode as required in Requirement R1. Such evidence may include, but is not limited to, dated evidence of transmittal of the procedure such as an electronic message or a transmittal letter with the procedure included or attached. If a generator is exempted, the Generator Operator shall also have evidence that the generator is	VAR-002-5, Measure M1 The Generator Operator shall have evidence to show that it notified its associated Transmission Operator any time it failed to operate a generating resource(s) in the automatic voltage control mode or in a different control mode as specified in Requirement R1. If a generating resource(s) is being started up or shut down with the automatic voltage control off, or is being tested, and no notification of the AVR status is made to the Transmission Operator, the Generator Operator will have evidence that it notified the Transmission Operator of its procedure for placing the unit into automatic voltage control mode as required in Requirement R1. Such evidence may include, but is not limited to, dated evidence of transmittal of the procedure such as an electronic message or a transmittal letter with the procedure included or attached. If a	Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.



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mode (with its AVR in service and controlling voltage).	automatic voltage control mode (with its AVR in service and controlling voltage), the Generator Operator will maintain evidence of an exception.	
VAR-002-4.1, Requirement R2 Unless exempted by the Transmission Operator, each Generator Operator shall maintain the generator voltage or Reactive Power schedule3 (within each generating Facility's capabilities4) provided by the Transmission Operator, or otherwise shall meet the conditions of notification for deviations from the voltage or Reactive Power schedule provided by the Transmission Operator. [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	VAR-002-5, Requirement R2 Unless exempted by the Transmission Operator, each Generator Operator shall maintain the generating resource(s) voltage or Reactive Power schedule3 (within each generating Facility's capabilities4) provided by the Transmission Operator, or otherwise shall meet the conditions of notification for deviations from the voltage or Reactive Power schedule provided by the Transmission Operator. [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	Requirement R2 has been maintained due to the importance of Generator Operator maintaining voltage or Reactive Power schedule within each generating Facility capabilities. The Project 2021-02 SDT proposed minor changes to bring attention to dispersed power producing resource as defined by the Bulk Electric System definition in the NERC Glossary of Terms for inclusion to Generation voltage or Reactive Power control resources and difference in type of voltage control as a volt/VAR controller for aggregated Generation system control at the Transmission Point of Interconnection or as stated in the Transmission Operator voltage or Reactive Power schedule instruction. Typical dispersed power producing resources have a site automatic voltage regulator (AVR) that coordinates the voltage of all generators to a common regulation point. If this site AVR controller(s) fails each generator will typically either continue to regulate at the last known set



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		point or revert to unity power factor. The Project 2021-02 SDT proposes adding language to provide Transmission Operator notification if no other control capability and without violation of Requirement R3. Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.
VAR-002-4.1, Requirement R2, Part 2.1 When a generator's AVR is out of service or the generator does not have an AVR, the Generator Operator shall use an alternative method to control the generator reactive output to meet the voltage or Reactive Power schedule provided by the Transmission Operator.	VAR-002-5, Requirement R2, Part 2.1 When an generating resource(s)'s AVR) is out of service or the applicable Facility does not have an AVR, the Generator Operator shall use an alternative method to control the applicable Facility reactive output to meet the voltage or Reactive Power schedule provided by the Transmission Operator or if no other method of control is available, notify the Transmission Operator as soon as becoming aware of the condition.	Requirement R2 has been maintained due to the importance of Generator Operator maintaining voltage or Reactive Power schedule within each generating Facility capabilities. The Project 2021-02 SDT proposed minor changes to bring attention to dispersed power producing resource as defined by the Bulk Electric System definition in the NERC Glossary of Terms for inclusion to Generation voltage or Reactive Power control resources and difference in type of voltage control as a volt/VAR controller for aggregated Generation system control at the Transmission Point of Interconnection or as stated in the Transmission Operator voltage or Reactive Power schedule instruction. Typical dispersed power producing resources have a site automatic voltage regulator (AVR) that coordinates the voltage of all generators to



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		a common regulation point. If this site AVR or volt/VAR controller(s) fails each generator will typically either continue to regulate at the last known set point or revert to unity power factor. The Project 2021-02 SDT proposes adding language to provide Transmission Operator notification if no other control capability and without violation of Requirement R3.
VAR-002-4.1, Requirement R2, Part 2.3 Generator Operators that do not monitor the voltage at the location specified in their voltage schedule shall have a methodology for converting the scheduled voltage specified by the Transmission Operator to the voltage point being monitored by the Generator Operator.	VAR-002-5, Requirement R2, Part 2.3 Generator Operators that do not monitor the voltage at the location specified in their voltage schedule shall have a methodology for converting the scheduled voltage to the voltage point being monitored by the Generator Operator.	Requirement R2 has been maintained due to the importance of Generator Operator maintaining voltage or Reactive Power schedule within each generating Facility capabilities. The Project 2021-02 SDT proposed minor changes to bring attention to dispersed power producing resource as defined by the Bulk Electric System definition in the NERC Glossary of Terms for inclusion to Generation voltage or Reactive Power control resources and difference in type of voltage control as a volt/VAR controller for aggregated Generation system control at the Transmission Point of Interconnection or as stated in the Transmission Operator voltage or Reactive Power schedule instruction.



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		Typical dispersed power producing resources have a site automatic voltage regulator (AVR) that coordinates the voltage of all generators to a common regulation point. If this site AVR fails each generator will typically either continue to regulate at the last known set point or revert to unity power factor. The Project 2021-02 SDT proposes adding language to provide Transmission Operator notification of limited control capability. Requirement R2, Part R2.1 was revised for the additional clarity needed for alternative control. For Requirement R2, Part R2.3 there needs to be a conversion methodology to determine how to adjust voltage to maintain schedule at monitoring point.
VAR-002-4.1, Measure M2 In order to identify when a generator is deviating from its schedule, the Generator Operator will monitor voltage based on existing equipment at its Facility. The Generator Operator shall have evidence to show that the generator maintained the voltage or Reactive Power schedule provided by the Transmission Operator, or shall have	VAR-002-5, Measure M2 In order to identify when a generating resource(s) is deviating from its schedule, the Generator Operator will monitor voltage based on existing equipment at its Facility. The Generator Operator will have evidence to show that the generating resource(s) maintained the voltage or Reactive Power schedule provided by	Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.



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evidence of meeting the conditions of notification for deviations from the voltage or Reactive Power schedule provided by the Transmission Operator. Evidence may include, but is not limited to, operator logs, SCADA data, phone logs, and any other notifications that would alert the Transmission Operator or otherwise demonstrate that the Generator Operator complied with the Transmission Operator's instructions for addressing deviations from the voltage or Reactive Power schedule. For Part 2.1, when a generator's AVR is out of service or the generator does not have an AVR, a Generator Operator shall have evidence to show an alternative method was used to control the generator reactive output to meet the voltage or Reactive Power schedule provided by the Transmission Operator. For Part 2.2, the Generator Operator shall have evidence that it complied with the Transmission Operator's instructions to modify its voltage or provided an explanation to the Transmission	the Transmission Operator or will have evidence of meeting the conditions of notification for deviations from the voltage or Reactive Power schedule provided by the Transmission Operator. Evidence may include, but is not limited to, operator logs, SCADA data, phone logs, and any other notifications that would alert the Transmission Operator or otherwise demonstrate that the Generator Operator complied with the Transmission Operator's instructions for addressing deviations from the voltage or Reactive Power schedule. For Part 2.1, when a generating resource(s)'s AVR or volt/VAR controller(s) is out of service or the generating resource(s) does not have an AVR, a Generator Operator shall have evidence to show an alternative method was used to control the generator reactive output to meet the voltage or Reactive Power schedule provided by the Transmission Operator or evidence of notification to the Transmission Operator if no other method of control is	
Operator of why the Generator Operator was unable to comply with the instruction. Evidence	available.	



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may include, but is not limited to, operator logs, SCADA data, and phone logs. For Part 2.3, for Generator Operators that do not monitor the voltage at the location specified on the voltage schedule, the Generator Operator shall demonstrate the methodology for converting the scheduled voltage specified by the Transmission Operator to the voltage point being monitored by the Generator Operator.	For Part 2.2, the Generator Operator will have evidence that it complied with the Transmission Operator's instructions to modify its voltage or provided an explanation to the Transmission Operator of why the Generator Operator was unable to comply with the instruction. Evidence may include, but is not limited to, operator logs, SCADA data, and phone logs. For Part 2.3, for Generator Operators that do not monitor the voltage at the location specified on the voltage schedule, the Generator Operator will demonstrate the methodology for converting the scheduled voltage to the voltage point being monitored by the Generator Operator.	
VAR-002-4.1, Requirement R3 Each Generator Operator shall notify its associated Transmission Operator of a status change on the AVR, power system stabilizer, or alternative voltage controlling device within 30 minutes of the change. If the status has been restored within 30 minutes of such change, then the Generator Operator is not required to notify the Transmission Operator of the status change.	VAR-002-5, Requirement R3 Each Generator Operator shall notify its associated Transmission Operator, in a mutually agreed communication method, within 30 minutes of becoming aware of an unexpected functionality change of its AVR, power system stabilizer, or alternative voltage controlling device If the status or functionality has been restored within 30 minutes of the change, then the Generator Operator is not required to notify the Transmission Operator of the change.	Requirement R3 has been modified to clarify the intent of the requirement for the Generator Operator to communicate to the Transmission Operator in a mutually-agreed criteria like other NERC Standards, e.g., TOP-003, for required notifications for when an AVR controller(s) meets the notification criteria. The Project 2021-02 SDT proposes additional clarity of status or functionality changes are those that impact the ability to control voltage which degrades or restores from degradation and to



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[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	exclude notifications that have change in status due to normal characteristics of running the Generation resource or do not meet the Transmission Operator threshold for reporting. The Generator Operator is required to notify the Transmission Operator of power system stabilizer (PSS) unavailability. The Project 2021-02 SDT agreed that the operational requirements for initial state of PSS (on/off) clarity was needed for expectations on startup, shutdown, or testing mode. To clarify notification for PSS status change, the Project 2021-02 SDT proposes to add language of functionality changes that degrade or restore its ability to automatically control voltage.
VAR-002-4.1, Measure M3	VAR-002-5, Measure M3	
The Generator Operator shall have evidence it notified its associated Transmission Operator within 30 minutes of any status change identified in Requirement R3. If the status has been restored within the first 30 minutes, no notification is necessary.	Each Generator Operator shall have evidence it notified its associated Transmission Operator within 30 minutes of a status change of its AVR or within 30 minutes of becoming aware of an unexpected functionality change identified in Requirement R3 If the status or functionality change has been restored within the first 30 minutes, no notification is necessary.	The intent to degrade and restore from degradation is meant to address the site controllers that are partially degraded the ability to automatically control voltage to follow instruction or facility degraded reactive capability to TOP for assessing regional system reactive resource capability impacts.



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VAR-002-4.1, Requirement R4 Each Generator Operator shall notify its associated Transmission Operator within 30 minutes of becoming aware of a change in reactive capability due to factors other than a status change described in Requirement R3. If the capability has been restored within 30 minutes of the Generator Operator becoming aware of such change, then the Generator Operator is not required to notify the Transmission Operator of the change in reactive capability. [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations] • Reporting of status or capability changes as stated in Requirement R4 is not applicable to the individual generating units of dispersed power producing resources identified through Inclusion I4 of the Bulk Electric System definition.	Each Generator Operator shall notify its associated Transmission Operator, in a mutually-agreeable communication method, within 30 minutes of becoming aware of a reactive capability change due to factors other than those specified in Requirement R3 at the generating resource(s). Where the Transmission Operator has specified a reactive capability threshold, the Generator Operator shall report reactive capability changes that create degradation or restores from degradation. If the capability has been restored within 30 minutes of the Generator Operator becoming aware of such change, then the Generator Operator is not required to notify the Transmission Operator of the change in reactive capability. [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]	Requirement R4 has been modified to clarify the intent of Requirement for Generator Operator to communicate to the Transmission Operator in a mutually-agreed criteria like other NERC Standards, e.g., TOP-003, for required notifications when Generator controlled reactive resources change in real time operations and impact the output of the generation facility other than AVR controller(s) specified in R3. The Project 2021-02 SDT proposes additional clarity of capability changes are those that meet the threshold for notification from the Transmission Operator that Transmission would deem to have an impact on assessing Generation reactive resources in real time as required by the Transmission Operator in VAR-001 R2. The Project 2021-02 SDT proposes to remove the bulleted requirement exempting individual generating units of dispersed Generation resources determining this requirement was not necessary if Transmission Operator provides the threshold of reporting. The Transmission Operator would be in best position to evaluate BES element impacts to system operations for Real-time assessment and monitoring as reactive resources change and excluding single



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		generating units of dispersed Generation does not provide enough clarity to what reporting is required for dispersed generation. Furthermore, excluding individual generating units of dispersed Generation resources from Requirement R4 reporting may pose a conflict with other enforceable Standards requiring this type of data such individual generating unit on/off status.
		The intent to degrade and restore from degradation is meant to address the site controllers that are partially degraded the ability to automatically control voltage to follow instruction or facility degraded reactive capability to TOP for assessing regional system reactive resource capability impacts.
VAR-002-4.1, Measure M4	VAR-002-5, Measure M4	Requirement R4 has been modified to clarify the intent of Requirement for Generator Operator
The Generator Operator shall have evidence it notified its associated Transmission Operator within 30 minutes of becoming aware of a change in reactive capability in accordance with Requirement R4. If the capability has been restored within the first 30 minutes, no notification is necessary.	Each Generator Operator shall have evidence it notified its associated Transmission Operator within 30 minutes of becoming aware of a change in reactive capability in accordance with Requirement R4. If the capability has been restored within the first 30 minutes, no notification is necessary.	to communicate to the Transmission Operator in a mutually agreed criteria like other NERC Standards, e.g., TOP-003, for required notifications when Generator controlled reactive resources change in Real-time operations and impact the output of the generation facility other than AVR or volt/VAR controller(s) specified in R3.



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VAR-002-4.1, Requirement R5	VAR-002-5, Requirement R5	
The Generator Owner shall provide the following to its associated Transmission Operator and Transmission Planner within 30 calendar days of a request. [Violation Risk Factor: Lower] [Time Horizon: Real-time Operations]	The Generator Owner for each generating resource(s) shall provide the following to its associated Transmission Operator and Transmission Planner within 30 calendar days of a request. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	Requirement R5 and corresponding measure have been maintained due to the importance of having accurate tap settings. If not properly set, then the VARs available from that unit can be affected. This requirement has been modified to update R5.1 for technology neutral language with respect to transformer modeling data by removing the words, "fixed tap ranges." The
		Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.
VAR-002-4.1, Requirement R5, Part 5.1.2	VAR-002-5, Requirement R5, Part 5.1.2	
Available fixed tap ranges.	Available tap ranges.	Requirement R5 and corresponding measure have been maintained due to the importance of having accurate tap settings. If not properly set, then the VARs available from that unit can be affected. This requirement has been modified to update R5.1 for technology neutral language with respect to transformer modeling data by removing the words, "fixed tap ranges." The Project 2021-02 SDT agrees with the Project



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		2016-EPR-02 and proposes to update the Operations Planning horizon to Real-Time horizon, due to requirement for Generator Owner to provide data to the Transmission Operator and Transmission Planner within 30 calendar days of a request.		
VAR-002-4.1, Measure M5	VAR-002-5, Measure M5			
The Generator Owner shall have evidence it provided its associated Transmission Operator and Transmission Planner with information on its step-up and auxiliary transformers as required in Requirement R5, Part 5.1.1 through Part 5.1.3 within 30 calendar days.	The Generator Owner for each generating resource(s) shall have evidence it provided its associated Transmission Operator and Transmission Planner with information on its step-up and auxiliary transformers as required in Requirement R5, Part 5.1.1 through Part 5.1.3 within 30 calendar days.	Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.		
VAR-002-4.1, Requirement R6 After consultation with the Transmission Operator regarding necessary step-up transformer tap changes, the Generator Owner shall ensure that transformer tap positions are changed according to the specifications provided by the Transmission Operator, unless such action would violate safety, an equipment rating, a regulatory requirement, or a statutory requirement. [Violation Risk Factor: Lower] [Time Horizon: Real-time Operations]	VAR-002-5, Requirement R6 After consultation with the Transmission Operator regarding necessary generator owned step-up transformer tap changes, the Generator Owner for each generating resource(s) shall ensure that transformer tap positions are changed according to the specifications provided by the Transmission Operator, unless such action would violate safety, an Equipment Rating, a regulatory requirement, or a statutory	Requirement R6 and corresponding measure have been maintained due to the importance of having accurate tap settings. If not properly set, then the VARs available from that unit can be affected. This requirement has been modified to capitalize the words, "equipment rating," for a NERC defined term. Step-up transformer tap changes according to the specifications provided by the Transmission Operator will typically involve an outage of the transformer and is the culmination of a longer term process		



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	requirement. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]	to determine if a transformer tap change is appropriate, therefore the Project 2021-02 SDT agrees with the Project 2016-EPR-02 and proposes changing the time horizon from Real-Time Operations to Operations Planning horizon. Section 4.2 has been revised to "generating		
		resource(s) to specifically include BES definition aspects.		
VAR-002-4.1, Requirement Part R6.1	VAR-002-5, Requirement Part R6.1			
If the Generator Owner cannot comply with the Transmission Operator's specifications, the Generator Owner shall notify the Transmission Operator and shall provide the technical justification.	If the Generator Owner for each generating resource(s) cannot comply with the Transmission Operator's specifications, the Generator Owner for each generating resource(s) shall notify the Transmission Operator and shall provide the technical justification.	Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.		
VAR-002-4.1, Measure M6 The Generator Owner shall have evidence that its step-up transformer taps were modified per the Transmission Operator's documentation in accordance with Requirement R6. The Generator Owner shall have evidence that it notified its associated Transmission Operator when it could	VAR-002-5, Measure M6 The Generator Owner for each generating resource(s) shall have evidence that its step-up transformer taps were modified per the Transmission Operator's documentation in accordance with Requirement R6. The Generator Owner of each generating	Section 4.2 has been revised to "generating resource(s)" to specifically include BES definition aspects.		
not comply with the Transmission Operator's	resource(s) y shall have evidence that it notified			



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step-up transformer tap specifications in accordance with Requirement R6, Part 6.1.	its associated Transmission Operator when it could not comply with the Transmission Operator's step-up transformer tap specifications in accordance with Requirement R6, Part 6.1.		