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| NOGRR Number | [195](http://www.ercot.com/mktrules/issues/NOGRR195) | NOGRR Title | Generator Voltage Control Tolerance Band |
| Date of Decision | | October 3, 2019 | |
| Action | | Tabled | |
| Timeline | | Normal | |
| Proposed Effective Date | | To be determined | |
| Priority and Rank Assigned | | To be determined | |
| Nodal Operating Guide Sections Requiring Revision | | 2.2.10, Generation Resource Response Time Requirements  2.7.3.1, Operational Guidelines  2.7.3.4, QSE Responsibilities  2.7.3.5, Resource Entity Responsibilities and Generation Resource Requirements | |
| Related Documents Requiring Revision/Related Revision Requests | | None | |
| Revision Description | | This Nodal Operating Guide Revision Request (NOGRR) addresses ERCOT audit recommendations from Texas Reliability Entity, Inc. (Texas RE) and proposes to modify generator voltage control tolerance bands. | |
| Reason for Revision | | Addresses current operational issues.  Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/news/presentations/2013/ERCOT%20Strat%20Plan%20FINAL%20112213.pdf) or directed by the ERCOT Board).  Market efficiencies or enhancements  Administrative  Regulatory requirements  Other: (explain)  *(please select all that apply)* | |
| Business Case | | ERCOT submits this NOGRR in order to address four items in Section 2 of the Nodal Operating Guide.  First, in response to a Texas RE audit recommendation, ERCOT proposes to clarify the conditions of notification for deviations from a Voltage Set Point so that they are clear and measurable. Current language simply includes “as soon as practicable.” ERCOT proposes to modify paragraphs (2) and (3) of Section 2.2.10 and paragraphs (3) and (4) of Section 2.7.3.5 to include a maximum time frame of 10 minutes from receipt of the applicable instruction or deviation from the tolerance band identified in paragraph (4) of Section 2.7.3.5. The proposed revisions would provide clear and measurable requirements in connection with North American Electric Reliability Corporation (NERC) Reliability Standard VAR-002-4.1, Requirement R2, that action should be taken as soon as practicable, but not longer than 10 minutes from the triggering event.  Second, ERCOT proposes edits to paragraph (1)(a) of Section 2.7.3.1 in order to add general operational voltage limits for existing and future voltage levels.  Third, ERCOT proposes to clarify and standardize the generator voltage control tolerance which, in its current form of 2%, varies depending on what the actual Voltage Set Point is at any given time. Currently, this tolerance is a +/-2% threshold for all kV levels, which can equate up to more than a 14kV spread for 345kV connected generators. That spread is excessive at 138kV and 345kV levels, and does not support reliable voltage control. The tolerance threshold moves depending on what the Voltage Set Point is at the Point of Interconnection (POI), and it can be confusing to track if a Voltage Set Point instruction is given. This NOGRR introduces a fixed threshold in terms of kV and is grouped by base voltage level, which is more easily tracked and measured by System Operators. The tolerances will improve voltage control, especially with higher nominal kV POIs. With the addition of Nodal Protocol Revision Request (NPPR) 776, Voltage Set Point Communication, telemetered Voltage Set Points and POI voltages allow for a common reference point that mitigates historical target and voltage reference discrepancies. Currently, the tolerance bands allow for generators to drift far from their desired Voltage Set Point, which makes it difficult to maintain the reliability on the system.  Fourth, ERCOT proposes to require Automatic Voltage Regulator (AVR) settings be set so that full reactive capability is deployed prior to going beyond the tolerance bands. This revision will help ensure that settings such as deadband and droop settings are coordinated, along with plant controllers, to automatically regulate voltage within the tolerance band. Some generators have been found to incorrectly set the deadband to 2%, or the droop settings well close to the 2%, which leads to wide voltage fluctuations before the AVR begins to modify voltage to help control closer to the Voltage Set Point. ERCOT expects the deadband to be much smaller than the tolerance band and droop setting set within the tolerance band. ERCOT recognizes that some AVR settings must be coordinated with other generators’ AVR settings behind the same POI or that are electrically close so that AVR controllers will not be fighting against each other, but instead working together to provide reliable voltage control. | |
| ROS Decision | | On 9/5/19, ROS unanimously voted to table NOGRR195 for one month. All Market Segments were present for the vote.  On 10/3/19, ROS unanimously voted to table NOGRR195 and refer the issue to the Voltage Profile Working Group (VPWG) and Operations Working Group (OWG). All Market Segments were present for the vote. | |
| Summary of ROS Discussion | | On 9/5/19, participants discussed specifics of the timeline for notification of and compliance with Voltage Set Point instructions in various scenarios. Some Market Participants requested additional information regarding potential reliability issues or other concerns that prompted the changes proposed in NOGRR195.  On 10/3/19, ERCOT Staff summarized additional analysis requested by Market Participants. Market Participants expressed concern for proposed response timelines and switching the basis of the generator voltage control tolerance band to an explicit kV level instead of the current percentage. | |

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| **Comments Received** | |
| Comment Author | **Comment Summary** |
| None |  |

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| Market Rules Notes |

None

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| Proposed Guide Language Revision |

**2.2.10 Generation Resource Response Time Requirements**

(1) All Generation Resources providing Voltage Support Service (VSS) as described in Protocol Section 3.15, Voltage Support, shall maintain the necessary procedures and processes plus communications, telemetry, remote control, automation, and staffing in order to normally comply with the response times listed below when a VSS Dispatch Instruction or a TO Voltage Set Point instruction, as described in Protocol Section 6.5.7.7, Voltage Support Service, is given. Compliance is based upon normal operating conditions where VSS Dispatch Instructions respect all equipment operating limits and other restrictions that are periodically placed on equipment. The response time to a VSS Dispatch Instruction or a TO Voltage Set Point instruction shall commence with the successful receipt by the QSE or Generation Resource either through a verbal or telemetered instruction.

(2) A Resource Entity, TO, or QSE is not required to comply with a VSS Dispatch Instruction or Voltage Set Point instruction if compliance with such an instruction is impossible due to either a Force Majeure Event or one or more of the conditions described in paragraphs (1) and (2) of Protocol Section 6.5.7.9, Compliance with Dispatch Instruction. In the event compliance with an instruction is precluded under this paragraph:

(a) An affected Resource Entity shall, as soon as practicable, notify its QSE, and the Resource Entity or its QSE shall, as soon as practicable, but not longer than 10 minutes from receipt of the instruction by the Resource Entity, notify the Entity issuing the instruction; and

(b) An affected TO shall, as soon as practicable, but not longer than 10 minutes from notification from the Resource Entity or its QSE, notify ERCOT.

(3) The required VSS response times for Generation Resources are:

(a) For automatically switchable static Volt-Ampere reactive (VAr) capable devices, when voltage or reactive measurements at the POI are outside of the Voltage Set Point tolerance band identified in paragraph (4) of Section 2.7.3.5, Resource Entity Responsibilities and Generation Resource Requirements; then the response must be fully deployed in no more than five minutes. If a TO and a Resource Entity have determined that a longer response time is appropriate and have entered into a written agreement reflecting that response time, then the Generation Resource shall be required to comply with that agreed response time so long as it does not exceed ten minutes.

(b) Response to a TO Voltage Set Point instruction shall be completed in no more than five minutes from receipt of the instruction.

(c) Response to a VSS Dispatch Instruction that requires a change to the real power output of the Generation Resource shall be completed as soon as practicable, but not longer than 10 minutes from receipt of the instruction by the Resource Entity.

(4) Shutting down and disconnecting Generation Resources from the ERCOT Transmission Grid:

(a) On-Line Generation Resources must be able to commence their shutdown sequence within five minutes of receipt of a Dispatch Instruction from ERCOT. Nuclear-fueled Generation Resources shall comply with the procedural requirements of the Nuclear Regulatory Commission (NRC) when receiving Dispatch Instructions from ERCOT to disconnect the Generation Resource from the ERCOT Transmission Grid.

(b) If the ERCOT Transmission Grid condition requires breaker or switch operations to disconnect a non-MW producing generator from the system, such operations shall be completed as soon as practicable, but no longer than 15 minutes of the receipt of a Dispatch Instruction from ERCOT. Once disconnected from the ERCOT Transmission Grid, a Generation Resource shall complete as soon as practicable, but no longer than 15 minutes, the required switching to return the system to a normal configuration except for nuclear-fueled Generation Resources, which shall comply with the procedural requirements of the NRC when receiving Dispatch Instructions from ERCOT to disconnect the Generation Resource from the ERCOT Transmission Grid.

**2.7.3.1 Operational Guidelines**

(1) The following guidelines describe ideal system operational characteristics and do not establish requirements for any particular Entity:

(a) General operational voltage limits are:

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| Nominal Voltage | Normal Operating Limits | Emergency Operating Limits |
| 345 | 327.75 – 362.25 | 310.5 – 379.5 |
| 230 | 218.5 – 241.5 | 207 – 253 |
| 138 | 131.1 – 144.9 | 124.2 – 151.8 |
| 115 | 109.25 – 120.75 | 103.5 – 126.5 |
| 69 | 65.55 – 72.45 | 62.1 – 75.9 |

(b) Except for Transmission Facilities that are designed to operate outside of normal operating limits, transmission voltage should not exceed 105% nor fall below 95% of the nominal voltage during normal operation of the system.

(c) Transmission voltage during emergencies (including contingency events) should not exceed equipment over-excitation ratings.

(d) Transmission voltage during emergencies (including contingency events) should not result in customer voltage exceeding or falling below prescribed limits at distribution substations on the transmission system.

(e) Transmission voltage post contingency should not exceed 110% nor fall below 90% of the per-unit voltage, unless more restrictive limits have been specified by the TSP for their system, then those limits shall not be exceeded.

(f) Transmission voltage post contingency should not fall below any Under-Voltage Load Shedding (UVLS) set point during normal operations.

(g) The accuracy of any transmission voltage that appears to exceed normal or emergency limits should be verified prior to taking further actions.

(h) Major transmission lines should be kept in service during light Load as much as possible. Lines should only be removed after all applicable reactive controls are implemented and the practicality of additional generation Dispatch has been considered. Time permitting, studies should be conducted to verify that reliability will not be degraded by removing any major transmission line from service.

(i) Generally speaking, static reactive devices should be brought On-Line before predicted daily maximum Load or before dynamic reactive Resources reach operating limits. Static reactive devices will be taken Off-Line during daily Load decline and before dynamic reactive Resources reach operating limits.

2.7.3.4 QSE Responsibilities

(1) Each QSE shall ensure that any Generation Resource that it represents and that is required to provide VSS responds to any VSS Dispatch Instruction including VSS Dispatch Instruction to exceed its CURL or URL or TO Voltage Set Point instruction within the time requirements specified in paragraph (3)(b) of Section 2.2.10, Generation Resource Response Time Requirements, even if the new Voltage Set Point is within the tolerance band identified in paragraph (4) of Section 2.7.3.5, Resource Entity Responsibilities and Generation Resource Requirements. If the Resource Entity notifies the QSE that a Generation Resource cannot comply with the VSS Dispatch Instruction or TO Voltage Set Point instruction, either the Resource Entity or its QSE shall, as soon as practicable, notify the Entity that issued the instruction. The Resource Entity or its QSE shall provide the reason for not being able to comply and an estimated time for resolution, when known.

(2) Each QSE representing a Generation Resource shall provide in Real-Time the desired Voltage Set Point and the associated POI kV measurement to the Generation Resource.

(3) Each QSE will continuously monitor the status of its Generating Resources’ AVRs and PSSs.

(4) Each QSE must, as soon as practicable, notify ERCOT when a Generation Resource experiences a change that affects its reactive capability, including any change to the operation mode of the Generation Resource’s AVR.

2.7.3.5 Resource Entity Responsibilities and Generation Resource Requirements

(1) Each Resource Entity shall ensure that its Generation Resource(s) responds to all VSS Dispatch Instruction or a TO Voltage Set Point instruction from its QSE or interconnecting TO within the time requirements specified in paragraph (3)(b) of Section 2.2.10, Generation Resource Response Time Requirements, even if the new Voltage Set Point is within the tolerance band identified in paragraph (4) below.

(2) Generation Resources with high reactive loading resulting from abnormal conditions shall not reduce their reactive loading without the consent of ERCOT unless equipment damage is imminent based on the sole and reasonable judgment of the Resource Entity. In that case the Resource Entity will notify its QSE and its TO as soon as practicable of its action.

(3) Each Resource Entity shall monitor Real-Time provided Voltage Set Point instructions it receives. The Resource Entity shall inform its QSE and either the Resource Entity or its QSE shall notify the Resource Entity’s TO, as soon as practicable, but not longer than 10 minutes from receipt of the instruction by the Resource Entity, if it cannot comply with TO Voltage Set Point instructions, or not longer than 10 minutes from being outside of the tolerance band if it cannot maintain the POI voltage within the tolerance band identified in paragraph (4) below. If a Resource Entity cannot comply with a VSS Dispatch Instruction, the Resource Entity shall inform its QSE and its QSE shall notify ERCOT as soon as practicable but not longer than 10 minutes from the receipt of the instruction by the Resource Entity.

(4) A Resource Entity required to provide VSS shall maintain the generator voltage or Reactive Power schedule within a tolerance band of the Voltage Set Point while operating at less than or equal to the maximum reactive capability of the Generation Resource. AVR settings may need to be coordinated with other Generation Resources. The Resource Entity shall ensure that its Generation Resources AVR settings (e.g. droop and deadband settings) are set such that the Generation Resource will deploy its full reactive capability prior to the POI voltage going beyond the tolerance band of the Voltage Set Point. The tolerance bands are as follows:

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| Nominal Voltage | Tolerance  Band KV |
| 345 | +/- 3kV |
| 230 | +/- 3kV |
| 138 | +/- 2kV |
| 115 | +/- 2kV |
| 69 | +/- 1kV |

(5) Required reactive capability must be maintained at all times that the Generation Resource is On-Line. When a Generation Resource experiences a change that affects its reactive capability, the associated Resource Entity shall notify its QSE and TO, as soon as practicable.

(6) Each Resource Entity shall communicate any generator-owned transmission voltage limits that deviate from those identified in Section 2.7.3.1, Operational Guidelines, to ERCOT and to its QSE.