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| NOGRR Number | [196](http://www.ercot.com/mktrules/issues/NOGRR196) | NOGRR Title | Related to NPRR973, Add Definitions for Generator Step-Up and Main Power Transformer |
| Date of Decision | August 11, 2020 |
| Action | Approved |
| Timeline | Normal |
| Effective Date | Upon system implementation of Nodal Protocol Revision Request (NPRR) 973, Add Definitions for Generator Step-Up and Main Power Transformer |
| Priority and Rank Assigned | Not Applicable |
| Nodal Operating Guide Sections Requiring Revision  | 2.9, Voltage Ride-Through Requirements for Generation Resources3.3, Resource Entities3.3.2.1, Corrected Unit Reactive Limits (CURL) |
| Related Documents Requiring Revision/Related Revision Requests | NPRR973 Planning Guide Revision Request (PGRR) 074, Related to NPRR973, Add Definitions for Generator Step-Up and Main Power TransformerResource Registration Glossary Revision Request (RRGRR) 022, Related to NPRR973, Add Definitions for Generator Step-Up and Main Power Transformer |
| Revision Description | This Nodal Operating Guide Revision Request (NOGRR) clarifies language by use of NPRR973-proposed defined terms Generation Step-Up (GSU) and Main Power Transformer (MPT). |
| Reason for Revision |  Addresses current operational issues. Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/wcm/lists/144926/ERCOT_Strategic_Plan_2019-2023.pdf) or directed by the ERCOT Board). Market efficiencies or enhancements Administrative Regulatory requirements Other: (explain)*(please select all that apply)* |
| Business Case | For Wind-powered Generation Resources (WGRs), the transformer that steps up to transmission level voltage (with a high-side voltage greater than 60 kV) is referred to as the Main Power Transformer (MPT). The transformer that steps up from turbine level voltage (typically 600 – 700 V) to mid-voltage level (typically 34.5 kV) is referred to as the Generator Step-Up (GSU) transformer. NPRR973 proposes adding as defined terms Generator Step-Up and Main Power Transformer; these two terms are used in the Nodal Operating Guide. |
| ROS Decision | On 11/7/19, ROS voted unanimously to table NOGRR196 and refer the issue to the Operations Working Group (OWG) and the Planning Working Group (PLWG). All Market Segments were present for the vote.On 1/9/20, ROS voted unanimously to recommend approval of NOGRR196 as revised by ROS. All Market Segments were present for the vote.On 2/6/20, ROS voted unanimously to endorse and forward to TAC the 1/9/20 ROS Report and Impact Analysis for NOGRR196. All Market Segments were present for the vote. |
| Summary of ROS Discussion | On 11/7/19, there was no discussion.On 1/9/20, participants considered revisions recommended by PLWG.On 2/6/20, there was no discussion. |
| TAC Decision | On 6/24/20, TAC voted unanimously via roll call to recommend approval of NOGRR196 as recommended by ROS in the 2/6/20 ROS Report. All Market Segments were present for the vote. |
| Summary of TAC Discussion | On 6/24/20, there was no discussion. |
| ERCOT Opinion | ERCOT supports approval of NOGRR196. |
| Board Decision | On 8/11/20, the ERCOT Board approved NOGRR196 as recommended by TAC in the 6/24/20 TAC Report. |

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| Market Segment | Not Applicable |

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

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| Market Rules Notes |

Please note the baseline Nodal Operating Guide language in the following sections has been updated to reflect the incorporation of the following NOGRR(s) into the Nodal Operating Guide:

* NOGRR204, Related to NPRR989, BESTF-1 Energy Storage Resource Technical Requirements
	+ Section 2.9
	+ Section 3.3.2.1

Please note the following NOGRR(s) also propose revisions to the following section(s):

* NOGRR208, Related to NPRR1002, BESTF-5 Energy Storage Resource Single Model Registration and Charging Restrictions in Emergency Conditions
	+ Section 3.3
* NOGRR209, Related to NPRR1003, Elimination of References to Resource Asset Registration Form
	+ Section 3.3.2.1
* NOGRR210 Related to NPRR1005, Clarify Definition of POI and Add Definition of POIB
	+ Section 3.3.2.1
* NOGRR212 Related to NPRR1005, Clarify Definition of POI and Add Definition of POIB
	+ Section 2.9

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| Proposed Guide Language Revision |

2.9 Voltage Ride-Through Requirements for Generation Resources

(1) Generation Resources must be designed and generation voltage relays must be set to remain connected to the transmission system during the following operating conditions:

(a) Generator terminal voltages are within 5% of the rated design voltage and volts per hertz are less than 105% of generator rated design voltage and frequency;

(b) Generator terminal voltage deviations exceed 5% but are within 10% of the rated design voltage and persist for less than ten seconds;

(c) Generator volts per hertz conditions are less than 116% of generator rated design voltage and frequency and last for less than 1.5 seconds;

(d) A transmission system fault (three-phase, single-phase or phase-to-phase), but not a generator bus fault, is cleared by the protection scheme coordinated between the Generation Entity and the Transmission Service Provider (TSP) on any line connected to the generator’s transmission interconnect bus, provided such lines are not connected to induction generators described in paragraph (12) of Protocol Section 3.15, Voltage Support; and

(e) In the case of a generator bus fault or a primary transmission system relay failure, the generator protective relaying may clear the generator independent of the operation of any transmission protective relaying.

(2) During operating conditions listed in paragraph (1) above, each Generation Resource shall not, during and following a transient voltage disturbance, cease providing real or reactive power except to the extent needed to provide frequency support or aid in voltage recovery.

(3) Generating Resources required to provide Voltage Support Service (VSS) shall have and maintain the following capability:

(a) Over-excitation limiters shall be provided and coordinated with the thermal capability of the generator field winding and protective relays in order to permit short-term reactive capability that allows at least 80% of the unit design standard (ANSI C50.13-1989), as follows:

Time (seconds) 10 30 60 120

Field Voltage % 208 146 125 112

After allowing temporary field current overload, the limiter shall operate through the automatic AC voltage regulator to reduce field current to the continuous rating. Return to normal AC voltage regulation after current reduction shall be automatic. The over-excitation limiter shall be coordinated with the over-excitation protection so that over-excitation protection only operates for failure of the voltage regulator/limiter.

(b) Under-excitation limiters shall be provided and coordinated with loss-of-field protection to eliminate unnecessary generating unit disconnection as a result of operator error or equipment malfunction.

(4) Generation Resources shall have protective relaying necessary to protect its equipment from abnormal conditions as well as to be consistent with protective relaying criteria described in Section 6.2.6.3.4, Generator Protection and Relay Requirements.

(5) The Voltage Ride-Through (VRT) requirements do not apply to faults that occur between the generator terminals and the transmission voltage side of the Main Power Transformer (MPT), or when clearing the fault effectively disconnects the Generation Resources from the ERCOT System.

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| ***[NOGRR204: Replace Section 2.9 above with the following upon system implementation of NPRR989:]*****2.9 Voltage Ride-Through Requirements for Generation Resources and Energy Storage Resources**(1) Generation Resources and Energy Storage Resources (ESRs) must be designed and their voltage relays must be set to remain connected to the transmission system during the following operating conditions:(a) Generator or inverter terminal voltages are within 5% of the rated design voltage and volts per hertz are less than 105% of generator rated design voltage and frequency;(b) Generator or inverter terminal voltage deviations exceed 5% but are within 10% of the rated design voltage and persist for less than ten seconds;(c) Generator or inverter volts per hertz conditions are less than 116% of rated design voltage and frequency and last for less than 1.5 seconds; and(d) A transmission system fault (three-phase, single-phase or phase-to-phase), but not a unit bus fault, is cleared by the protection scheme coordinated between the Resource Entity and the Transmission Service Provider (TSP) on any line connected to the Resource’s Point of Interconnection (POI), provided such lines are not connected to induction generators described in paragraph (12) of Protocol Section 3.15, Voltage Support. (2) In the case of a unit bus fault or a primary transmission system relay failure, the unit protective relaying may clear the unit independent of the operation of any transmission protective relaying.(3) During operating conditions listed in paragraph (1) above, each Generation Resource or ESR shall not, during and following a transient voltage disturbance, cease providing real or reactive power except to the extent needed to provide frequency support or aid in voltage recovery. Each ESR, if it is consuming active power from the ERCOT System when operating in the charging mode, shall reduce or cease power consumption as necessary to aid in voltage recovery during and following transient voltage disturbances. (4) Synchronous Generation Resources required to provide Voltage Support Service (VSS) shall have and maintain the following capability:(a) Over-excitation limiters shall be provided and coordinated with the thermal capability of the generator field winding and protective relays in order to permit short-term reactive capability that allows at least 80% of the unit design standard (ANSI C50.13-1989), as follows: Time (seconds) 10 30 60 120 Field Voltage % 208 146 125 112 After allowing temporary field current overload, the limiter shall operate through the automatic AC voltage regulator to reduce field current to the continuous rating. Return to normal AC voltage regulation after current reduction shall be automatic. The over-excitation limiter shall be coordinated with the over-excitation protection so that over-excitation protection only operates for failure of the voltage regulator/limiter.(b) Under-excitation limiters shall be provided and coordinated with loss-of-field protection to eliminate unnecessary generating unit disconnection as a result of operator error or equipment malfunction.(5) Generation Resources and ESRs shall have protective relaying necessary to protect their equipment from abnormal conditions as well as to be consistent with protective relaying criteria described in Section 6.2.6.3.4, Generation Resource and Energy Storage Resource Protection and Relay Requirements.(6) The Voltage Ride-Through (VRT) requirements do not apply to faults that occur at or behind the POI, or when clearing the fault effectively disconnects the Resource from the ERCOT System. |

3.3 Resource Entities

(1) The operation of a Generation Resource shall conform to the requirements of the Protocols, North American Electric Reliability Corporation (NERC) Reliability Standards and these Operating Guides. As prescribed in Protocol Sections, 3.7.1.1, Generation Resource Parameters, 3.7.1.2, Load Resource Parameters, and 3.10.7.2, Modeling of Resources and Transmission Loads, the Qualified Scheduling Entities (QSEs) and Resource Entities shall provide ERCOT and the Transmission Service Provider (TSP) with modeling information describing each Generation and Load Resource.

(2) As prescribed in Protocol Section 3.10.7.1.4, Transmission, Main Power Transformers (MPTs) and Generator Step-Up (GSU) transformers, Resource Entities will provide information on these transformers to TSPs.

(3) As prescribed in Protocol Sections 3.10.7.5, Telemetry Criteria, 6.5.5.2, Operational Data Requirements, and 8, Performance Monitoring, the QSE reporting for a Resource Entity shall provide operational information for generation facilities greater than 10 MW.

(4) At a minimum, a Resource Entity shall notify ERCOT and the QSE of the following:

(a) 60 days prior to implementation of any planned equipment changes that affect the reactive capability of an operating Generation Resource.

(b) Any such changes that decrease the reactive capability of the Generation Resource below the required level and changes that decrease the Voltage Ride-Through (VRT) capability of the plant must be approved by ERCOT prior to implementation;

(c) As soon as practicable when high reactive loading or reactive oscillations on Generation Resources are observed; and

(d) As soon as practicable when a Generation Resource trips Off-Line due to voltage or reactive problems.

(5) When scheduled to ERCOT, Resource Entities shall be staffed or monitored 24x7, by personnel capable of making operating decisions. Each Resource Entity shall designate an Authorized Representative as defined in Protocol Section 2.1, Definitions. This applies to all:

(a) Generation Resources greater than 10 MW; and

(b) Load Resources.

(6) The Resource Entity shall implement the following in a reliable and safe manner and in accordance with the switching procedure of the directly connected TSP:

(a) Synchronizing of the generation to the ERCOT System; and

(b) Transmission switchyard switching or clearances.

(7) Any Resource or Customer-owned switching device that can interrupt flow through network transmission equipment, 60 kV or greater in nominal voltage, must have an agreement with the Transmission Operator (TO) to schedule Outages on, and perform emergency switching of, the device.

(8) The Generation Resource specifically licensed by a federal regulatory agency shall, through its QSE representative, provide any applicable grid interconnection and performance licensing requirements to ERCOT and the TSP to which the licensee is connected.

(9) The TSP is obligated to incorporate any such licensing requirements into its planning and operations, and ERCOT shall support such requirements. Both ERCOT and the TSP will create necessary procedures for satisfying these requirements. Such procedures will include provisions to notify the facility licensee through its QSE of any requirements that cannot be satisfied.

(10) Any proposal for revision of this Operating Guide and the procedures incorporating the licensee requirements that would diminish the obligation or ability of ERCOT or the TSP to support these requirements shall be provided to the licensee through its QSE to afford it an opportunity for review and response. Any such proposal that is approved, as a result of which the licensee is required to implement changes to meet its license requirements or to seek amendment to its license, shall become effective no sooner than six months following the approval.

(11) Resource Entities must provide Resource-owned Transmission Elements data requirements as prescribed in Protocol Section 3.10.7, ERCOT System Modeling Requirements. Additional distribution voltage level devices and connectivity may be required as well to adequately represent the modeling of the Resource within ERCOT computer systems.

3.3.2.1 Corrected Unit Reactive Limits (CURL)

(1) A reactive capability curve and associated data for each unit on the ERCOT System shall be submitted to ERCOT through the Market Information System (MIS) Certified Area and must contain the most limiting elements for the leading and lagging reactive output. The limiting factors such as under-excitation limiters, over-excitation limiters, ambient temperature limitations across the MW range of the unit at the unit terminals or any other factor that limits the reactive output of the unit and is verifiable through engineering calculations or testing shall be updated and provided on the corrected reactive capability curve. The corrected reactive capability curve establishes the Corrected Unit Reactive Limits (CURL) at the unit terminals that ERCOT Planning and ERCOT Operations, and TSPs will use for their studies. For Intermittent Renewable Resources (IRRs) the CURL data shall be reported at the low side of the MPT . Resources will provide these updated curves and associated test data to ERCOT by submitting test information to the Net Dependable Capability and Reactive Capability (NDCRC) application located on the MIS Secure Area. Once approved by ERCOT per Section 3.5, ERCOT Implementation, Resources will provide updated data by submitting changes to the appropriate ERCOT Resource Asset Registration Forms in accordance with Planning Guide Section 6.8, Resource Registration Procedures. Prior to including the submitted data into the Network Operations Model, ERCOT will notify the TSP to which the Resource Entity is interconnected that the test data is posted on the MIS Secure Area. ERCOT and TSPs may review the data and provide any comments within ten Business Days. ERCOT will include these changes in the future Network Operations Model and forward the changes to the TSPs and the Steady State Working Group (SSWG) for use in their studies. The CURL should be available in the Resource Entities’ control room where the tests are conducted and at the QSE’s Real-Time generation dispatch desk. During any test, the Generation Resource must maintain its generator cooling system at normal operating conditions, the automatic voltage regulator in service and all auxiliary equipment in service that is needed for expected normal operation.

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| [NOGRR204: Replace Section 3.3.2.1 above with the following upon system implementation of NPRR989:]**3.3.2.1 Corrected Unit Reactive Limits (CURL)**(1) A reactive capability curve and associated data for each unit on the ERCOT System shall be submitted to ERCOT through the Market Information System (MIS) Certified Area and must contain the most limiting elements for the leading and lagging reactive output. The limiting factors such as under-excitation limiters, over-excitation limiters, ambient temperature limitations across the MW range of the unit at the unit terminals or any other factor that limits the reactive output of the unit and is verifiable through engineering calculations or testing shall be updated and provided on the corrected reactive capability curve. The corrected reactive capability curve establishes the Corrected Unit Reactive Limits (CURL) at the unit terminals that ERCOT Planning and ERCOT Operations, and TSPs will use for their studies. For Intermittent Renewable Resources (IRRs) and Energy Storage Resources (ESRs) the CURL data shall be reported at the low side of the unit’s step up transformer to the Point of Interconnection (POI). Resources will provide these updated curves and associated test data to ERCOT by submitting test information to the Net Dependable Capability and Reactive Capability (NDCRC) application located on the MIS Secure Area. Once approved by ERCOT per Section 3.5, ERCOT Implementation, Resources will provide updated data by submitting changes to the appropriate ERCOT Resource Asset Registration Forms in accordance with Planning Guide Section 6.8, Resource Registration Procedures. Prior to including the submitted data into the Network Operations Model, ERCOT will notify the TSP to which the Resource Entity is interconnected that the test data is posted on the MIS Secure Area. ERCOT and TSPs may review the data and provide any comments within ten Business Days. ERCOT will include these changes in the future Network Operations Model and forward the changes to the TSPs and the Steady State Working Group (SSWG) for use in their studies. The CURL should be available in the Resource Entity’s control room where the tests are conducted and at the QSE’s Real-Time Resource dispatch desk. During any test, the Generation Resource or ESR must maintain its cooling system at normal operating conditions, the Automatic Voltage Regulator in service and all auxiliary equipment in service that is needed for expected normal operation. |