|  |  |  |  |
| --- | --- | --- | --- |
| NOGRR Number | 245 | NOGRR Title | Inverter-Based Resource (IBR) Ride-Through Requirements |

|  |  |
| --- | --- |
| Date | June 6, 2024 |

|  |  |
| --- | --- |
| Submitter’s Information | |
| Name | Joint Commenters 2 (Dave Azari; Carrie Bivens; Chase Smith; Thresa Allen; Hannah Muller) |
| E-mail Address | [dazari@invenergy.com](mailto:dazari@invenergy.com);[Carrie.Bivens@nexteraenergy.com](mailto:Carrie.Bivens@nexteraenergy.com); [bcsmi@southernco.com](mailto:bcsmi@southernco.com);[thresa.allen@avangrid.com](mailto:thresa.allen@avangrid.com); [hannah.muller@clearwayenergy.com](mailto:hannah.muller@clearwayenergy.com) |
| Company | Invenergy Energy Management LLC; NextEra Energy Resources LLC; Southern Power Company; Avangrid Renewables LLC; Clearway Renew, LC |
| Phone Number | 312-582-1533; 512-879-7971; 205-992-0145; 281-217-4764;  607-431-8811 |
| Cell Number | N/A |
| Market Segment | Independent Generators |

|  |
| --- |
| Comments |

From the discussion at the May 31, 2024 special TAC meeting, the previously TAC-approved version of NOGRR245 has been updated to reflect the direction provided to allow for immediate implementation of standards consistent with IEEE 2800 for new resources, maximize ride-through capabilities for existing resources that can be accomplished with software modifications and to decouple software and hardware ride-through considerations.

This updated:

* Establishes the most stringent ride-through standards in the country for both existing and new facilities.
* Requires all ERCOT Resources, including all existing resources, to maximize equipment capabilities to the greatest extent the equipment allows using prudent engineering judgment.
* Requires existing facilities to undertake significant analysis and modeling in coordination with OEMs and provide robust documentation of current ride-through capability and plans to maximize that capability, thereby providing ERCOT.
* Requires all existing facilities to make all available software updates (firmware, settings, parameters, etc.) to maximize ride-through capability. Resource Entities will be required to implement these modifications in a timely manner to support ERCOT system reliability.
* Establishes a clear compliance process for facilities that fail to meet performance requirements and/or fail to provide the required modeling and reporting information.

These proposed protocols represent a serious and good faith commitment to upgrades in the field in parallel with a collective learning process with ERCOT and stakeholders. The required modeling and documentation updates represent a significant improvement in data available for ERCOT to conduct meaningful reliability analyses. Resource Entities will implement the maximization concept and ensure dynamic models are updated and comprehensive reports filed. This work involves coordination with OEMs, third-party engineering firms, EPC contractors, modeling and study consultants, and other third-party service providers. The baseline information that will be established through this process will enable ERCOT and all stakeholders to make much more informed decisions regarding ERCOT System risk and any additional ride-through capability requirements that may be needed including requirements for hardware upgrades for existing facilities.

To facilitate TAC review, redlines related to discussions at the May 31 TAC meeting, including the decoupling recommendation, are highlighted below:

* A new Section 2.11 that clearly defines maximization and dictates how maximization will be required.
* An updated Section 2.12, which describes what actions are required after a ride-through event and specific compliance obligations and risks, to incorporate the maximization concept.
* Removal of the hardware requirements, commercial reasonability considerations, and the entire exemption process for legacy Resources, in expectation that these issues will be addressed in future stakeholder discussions and will be informed by the data gathering required by this initial NOGRR.
* Harmonization with ERCOT’s most recent redlines presented on May 31.
* Incorporation of TAC members’ recommendation to set the date defining “new” IBRs as SGIA execution on or after September 1, 2024, consistent with the earliest anticipated effective date following PUC approval.

The time and deliberation that TAC has invested in this process has directly improved the NOGRR. Revisions to the TAC-approved version were developed to comport with the guidance that TAC has given over the past two weeks.  To the maximum extent possible, these comments also seek to retain revisions proposed by ERCOT since remand from the Board of Directors in April.  The revisions included in the redlines below strike a reasonable balance between ERCOT’s desire to increase Voltage and Frequency ride-through capabilities among IBRs and the industry’s need to avoid potentially inefficient, expensive, and uncertain regulatory environment.

The redlines below include revisions proposed by ERCOT since the April Board action as well as revisions by the Joint Commenters. The table below notes revisions recommended in these comments that differ from the currently-TAC approved language.

|  |  |
| --- | --- |
| **Section** | **Reason** |
| 2.6.2 | To incorporate revisions sought by ERCOT. |
| 2.6.2.1 | To conform with ERCOT comments. reflect the decoupling proposal so that NOGRR is focused on maximization and added “dynamic reactive support” to paragraph (5).  Deleted paragraph (7) that was focused on physical modifications; changed the effective date to September 1 to avoid retroactive application. |
| 2.6.2.1.1 | Deleted because it is covered by maximization. |
| 2.9 | Minor changes to conform with ERCOT’s comments. |
| 2.9.1 | Deleted paragraph (7) that referred to physical modifications and changed the effective date to September 1. Added a requirement to maximize. Retained some language ERCOT proposed to delete related to the effective date and Type 3 WGRs. |
| 2.9.1.1 | Made conforming changes to match ERCOT comments, except did not make changes to Tables A and B that have not been reviewed by ROS. These newly proposed technical changes should go to ROS as part of a new NOGRR. |
| 2.9.1.2 | Retained 2.9.1.2 as a floor for 2.12 but clarified that not all resources were built to meet the new “legacy” requirements. They were built to comply with the Operating Guides that were in effect at the time they were built. |
| 2.11 | A new Section that clearly defines maximization and incorporates required maximization.  Consistent with prior TAC statements, removes the hardware requirements, commercial reasonability considerations, and the entire exemption process for legacy Resources in expectation that these issues will be addressed in future stakeholder processes informed by the data gathering required by this initial NOGRR. |
| 2.13.1 | Removed exemption concept consistent with change to Section 2.11. |
| 2.12 | Describe what actions are required after a ride-through event and specific compliance obligations and risks in order to incorporate the maximization concept and renumber the section. |

|  |  |
| --- | --- |
| **Revised Cover Page Language** | |
| **Nodal Operating Guide Sections Requiring Revision** | 2.6.2, Generators and Energy Storage Resources  2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs (new)  2.6.2.1, Frequency Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs)  2.6.2.1.1, Temporary Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs) (new)  2.9, Voltage Ride-Through Requirements for Generation Resources and Energy Storage Resources  2.9.1, Voltage Ride-Through Requirements for Intermittent Renewable Resources Connected to the ERCOT Transmission Grid  2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) (new)  2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs (new)  2.11, Maximizing Ride-Though Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs (new)  2.12, Actions of a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Does Not Ride Through (new)  2.12.1, Initial Frequency Ride-Through Capability Documentation and Reporting Requirements (new)  2.12.2, Initial Voltage Ride-Through Capability Documentation and Reporting Requirements (new)  2.12.3, Use of Initial Reports and Requirements for Recurring Ride-Through Reports (new)  2.13, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions, and Appeals (new)  2.13.1, Exemptions and Extensions (new)  2.13.1.1, Submission of Exemption Requests (new)  2.13.1.2, Submission of Extension Requests (new)  2.13.1.3, Timeline for Submission and Determination of Exemption and Extension Requests (new)  2.13.1.4, Procedure for Appealing an ERCOT Decision to Reject an Exemption or Extension Request (new)  2.13.1.4.1, Appeal Process and Timeline (new)  2.14, Actions Following an Apparent Failure to Ride-through (new) |
| **Revision Description** | This Nodal Operating Guide Revision Request (NOGRR) replaces the current voltage ride-through requirements for Intermittent Renewable Resources (IRRs) with voltage ride-through requirements for new Inverter-Based Resources (IBRs) and provides new frequency ride-through requirements for new IBRs and consistent with or beyond requirements identified in the new 2800-2022 - Institute of Electrical and Electronics Engineers (IEEE) Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems (“IEEE 2800-2022 standard”).  This NOGRR represents phase one of the implementation process of new voltage and frequency ride-through requirements for new and existing IBRs, Type 1 Wind-Generation Resources (WGRs) and Type 2 WGRs. Under phase one, new IBRs (i.e., IBRs with Standard Generation Interconnection Agreements (SGIAs) executed on/after September 1, 2024 will be required to meet these updated requirements. Furthermore, under phase one, existing IBRs, Type 1 WGRs and Type 2 WGRs will be required to maximize their ride-through capabilities with non-physical modifications as described in this NOGRR.  Phase two of the implementation process will be captured in a separate NOGRR, which will set forth any necessary requirements for implementing physical modifications to enhance/maximize ride-through capabilities of existing IBRs, Type 1 WGRs and Type 2 WGRs. |
| **Justification of Reason for Revision and Market Impacts** | ERCOT submits this NOGRR based on reliability issues associated with the inability of some IBRs to ride-through system disturbances, and in light of the IEEE 2800-2022 standard. In its recently issued guidance document *Inverter-Based Resource Strategy*, theNorth American Reliability Corporation (NERC) noted it has supported the development of the IEEE 2800-2022 standard (and continues to support the IEEE P2800.2, Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems, standards development efforts). Among other things, the document also highlights that:   * New technology can introduce significant risks if not integrated properlywhich could result in high impact and high likelihood events that require substantive action; * Inverter and plant controls and protection systems must support the reliable operation of the bulk power system during system disturbances; * Disturbance reports, alerts, guidelines, and other deliverables have shown that abnormal IBR performance issues pose a significant risk to bulk power system reliability; * Analyzed events identified new performance issues such as momentary cessation, unwarranted inverter or plant-level tripping issues, controller interactions and instabilities, and other critical performance risks that must be mitigated; and * Generation ride-through and provision of essential reliability services is a core principle for reliable operation of the bulk power system.   Consequently, this NOGRR proposes ride-through requirements for new IBRs with specificity consistent with or beyond the IEEE 2800-2022 standard where appropriate (e.g., applying to the Point of Interconnection Bus (POIB) instead of the “Resource Point of Applicability”). The revisions specify the ride-through requirements for [transmission-connected] IBRs rather than IRRs or Energy Storage Resources (ESRs) because some ESRs may not be IBRs and the IBR attributes create unique ride-through requirements. . Some clarifications included from the IEEE 2800-2022 standard may not require additional “capability” but provide additional specificity for settings that can prevent failures rather than adjustments being made after a failure occurs.  Failure of IBRs to ride-through normal frequency and voltage deviations on the ERCOT System can lead to severe consequences such as instability, cascading outages, or triggering an Under-Frequency Load Shed (UFLS) event which would result in the uncontrolled loss of firm Load. An IBR or Type 1 WGR or Type 2 WGR that will be replaced or retrofitted , must meet the latest IEEE 2800 standard and preferred voltage ride-through requirements.  Existing IBRs, Type 1 WGRs, and Type 2 WGRs must maximize their ride-through capabilities as described in Section 2.11.  The proposed requirements will help improve several of the major failure modes identified in the Odessa disturbances in 2021 and 2022. Many of the Odessa related issues have been addressed with software and settings changes, which this NOGRR will require to be implemented through maximization requirements. Market Participants in the Inverter Based Resource Task Force (IBRTF) encouraged ERCOT to focus on enhancements adopting portions of the IEEE 2800-2022 standard or NERC Reliability Guidelines that would provide the most reliability benefit in the short-term rather than a holistic approach. As such, additional requirements on IBRs may be necessary based on additional event analyses, lessons learned, recommendations contained in the NERC Odessa 2022 report, IEEE requirements, and NERC Reliability Standard revisions. |

|  |
| --- |
| **Revised Proposed Guide Language** |

***2.6.2 Frequency Ride-Through Requirements for Generation Resources and Energy Storage Resources***

(1) Except for Generation Resources and Energy Storage Resources (ESRs) subject to Sections 2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs or 2.6.2.2, Frequency Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs), if under-frequency relays are installed and activated to trip the Generation Resource or ESR, these relays shall perform such that the automatic removal of the Resource from the ERCOT System meets or exceeds the following requirements:

|  |  |
| --- | --- |
| **Frequency Range** | **Delay to Trip** |
| Above 59.4 Hz | No automatic tripping  (continuous operation) |
| Above 58.4 Hz up to  and including 59.4 Hz | Not less than 9 minutes |
| Above 58.0 Hz up to  and including 58.4 Hz | Not less than 30 seconds |
| Above 57.5 Hz up to  and including 58.0 Hz | Not less than 2 seconds |
| 57.5 Hz or below | No time delay required |

(2) Except for Generation Resources subject to Sections 2.6.2.1 or 2.6.2.2, if over-frequency relays are installed and activated to trip the Resource, then the Resource shall perform such that the automatic removal of the Resource from the ERCOT System meets or exceeds the following requirements:

|  |  |
| --- | --- |
| **Frequency Range** | **Delay to Trip** |
| Below 60.6 Hz down to and including 60 Hz | No automatic tripping (continuous operation) |
| Below 61.6 Hz down to and including 60.6 Hz | Not less than 9 minutes |
| Below 61.8 Hz down to and including 61.6 Hz | Not less than 30 seconds |
| 61.8 Hz or above | No time delay required |

(3) If frequency protection schemes are installed and activated to trip a Generation Resource or ESR, they shall use filtered quantities or add sufficient time delays to prevent misoperations while providing the desired equipment protection. Protection schemes shall not trip a Generation Resource or ESR based on an instantaneous frequency measurement.

(4) This Section shall not affect the Resource Entity’s duty to protect its equipment from damage. The Resource Entity for a Generation Resource or ESR subject to paragraphs (1) and (2) above that is unable to remain reliably connected to the ERCOT System as set forth in paragraphs (1) and (2), shall provide to ERCOT the reason(s) for the Resource’s limitation, including available study results or manufacturer recommendations, and the Resource’s frequency ride-through capability in the format shown in the tables in paragraphs (1) and (2) above.

***2.6.2.1 Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs***

(1) This Section applies to all IBRs, Type 1 Wind-powered Generation Resources (WGRs) and Type 2 WGRs connected to the ERCOT Transmission Grid. Such Resources shall ride through the frequency conditions at the Resource’s Point of Interconnection Bus (POIB) specified in the following table:

|  |  |
| --- | --- |
| Frequency (f) in (Hz) | Minimum Ride-Through Time  (seconds) |
| f > 61.8 | May ride-through or trip |
| 61.6 < f ≤ 61.8 | 299 |
| 61.2 < f ≤ 61.6 | 540 |
| 58.8 ≤ f ≤ 61.2 | continuous |
| 58.4 ≤ f < 58.8 | 540 |
| 57.0 ≤ f < 58.4 | 299 |
| f < 57.0 | May ride-through or trip |

(2) Nothing in paragraph (1) above shall be interpreted to require an IBR, Type 1 WGR or Type 2 WGR to trip for frequency conditions beyond those for which ride-through is required.

(3) If protection systems (including, but not limited to protection for over-/under-frequency, rate-of-change-of-frequency, anti-islanding, and phase angle jump) are installed and activated to trip the IBR, Type 1 WGR or Type 2 WGR, they shall enable the Resource to ride through frequency conditions beyond those defined in paragraph (1) above to the maximum level the equipment allows as required by Section 2.11, Maximizing Ride-Through Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs .

(4) An IBR or Type 1 WGR or Type 2 WGR shall inject electric current when required to ride-through frequency conditions.

(5) IBR, Type 1 WGR and Type WGR plant controls, turbine controls and/or inverter controls shall not disconnect the Resource from the ERCOT Transmission Grid during frequency conditions where ride-through is required. IBR, Type 1 WGR, and Type 2 WGR plant controls, turbine controls, and/or inverter controls shall not reduce the Resource’s active power output during frequency conditions requiring ride-through unless necessary for providing appropriate frequency response or dynamic Reactive Power support.

(6) The Resource Entity or IE of an IBR, Type 1 WGR or Type 2 WGR shall ensure the Resource’s frequency ride-through capability is set to the maximum level the equipment allows as set forth in Section 2.11, to meet or exceed the requirements of paragraphs (1) through (5) above. An IBR, Type 1 WGR or Type 2 WGR with a Standard Generation Interconnection Agreement (SGIA) executed prior to September 1, 2024, must comply with the frequency ride-through requirements in effect immediately prior to June 1, 2024 until such time the IBR maximizes its frequency ride-through capability as set forth in Section 2.11.



(7) If an IBR, Type 1 WGR or Type 2 WGR fails to perform in accordance with the applicable frequency ride-through requirements, the Resource Entity shall take actions described in Section 2.12, Actions if a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Does Not Ride Through.



























***2.6.2.2 Frequency Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs)***

(1) For any short-circuit fault or open-phase condition that occurs on the circuit to which the DGR or DESR is connected, the DGR or DESR will cease to energize and trip offline, and this will take priority over the frequency ride-through function.

(2) DGRs and DESRs must have over-/under-frequency relays set to ride through frequency conditions as specified in the following table:

|  |  |  |
| --- | --- | --- |
| Frequency (Hz) | Ride-Through Mode | Minimum Ride-through Time  (seconds) |
| *f > 61.8* | No ride-through requirements | |
| 61.2 < f ≤ 61.8 | Mandatory Operation | 299 |
| 58.8 ≤ f ≤ 61.2 | Continuous Operation | continuous |
| 57.0 ≤ f < 58.8 | Mandatory Operation | 299 |
| *f < 57.0* | No ride-through requirements | |

(3) Any Resource Entity with a DGR or DESR utilizing inverter-based generation that achieved Initial Synchronization before April 1, 2020 that is not capable of complying with the requirements of paragraph (2) above may request an exemption from those requirements. Such a request shall be submitted by November 2, 2020 and shall include documentation that demonstrates the DGR’s or DESR’s frequency ride-through capability to ERCOT’s satisfaction. If, after reviewing the request and documentation, ERCOT determines the DGR or DESR is not capable of complying with the requirements of paragraph (2), then the DGR or DESR shall be exempt from those requirements, but shall be required to comply with those requirements to the greatest degree possible within its capability, as determined in writing by ERCOT. Upon replacement or retirement of the inverter, the DGR or DESR shall no longer be exempt and shall at that time be required to comply with the requirements of paragraph (2) or other applicable requirement.

**2.9 Voltage Ride-Through Requirements for Generation Resources and Energy Storage Resources**

(1) Except for Generation Resources and Energy Storage Resources (ESRs) subject to Sections 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, or 2.9.2, Voltage Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs), each Generation Resource or ESR must remain reliably connected to the ERCOT Transmission Grid during the following:

(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 and ESR subject to paragraph (1) shall not, during and following a transient voltage disturbance, cease providing real or reactive current except to the extent needed to provide frequency support or aid in voltage recovery. Each ESR, if 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 over-excitation protection operates only 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 equipment from abnormal conditions and be consistent with protective relaying criteria described in Section 6.2.6.3.4, Generator and Energy Storage Resource Protection and Relay Requirements.

(6) The voltage ride-through requirements, including Section 2.9.1, do not apply to faults at or behind the Point of Interconnection (POI) when clearing the fault effectively disconnects the Generation Resource from the ERCOT System.

(7) A Generation Resource or ESR may be tripped Off-Line or curtailed after the fault clearing period if part of an approved Remedial Action Scheme (RAS).

(8) The Resource Entity of each Generation Resource or ESR shall provide to ERCOT technical documentation of voltage ride-through capability upon request.

***2.9.1 Voltage Ride-Through Requirements for Transmission-Connected*** ***Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs***

(1) All Inverter-Based Resources (IBRs), Type 1 Wind-powered Generation Resources (WGRs) and Type 2 WGRs interconnected to the ERCOT Transmission Grid shall comply with voltage ride-through requirements as follows:

(a) Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) shall apply to:

(i) An IBR with a Standard Generation Interconnection Agreement (SGIA) executed on or after September 1, 2024.

(ii) An IBR that implements any modification, as described in paragraph (1)(c) of Planning Guide Section 5.2.1, Applicability, for which upgrades or facilities under a Generator Interconnection or Modification (GIM) was initiated on or after September 1, 2024 unless the modification was fully implemented prior to January 1, 2028.

(b) Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, shall apply to IBRs not subject to Section 2.9.1.1, and Type 1 WGRs and Type 2 WGRs.

(2) An IBR with an SGIA executed on or after September 1, 2024 or that implements a modification, as described in paragraph (1)(c) of Planning Guide Section 5.2.1 for which a GIM was initiated on or after September 1, 2024 unless the modification was fully implemented prior to January 1, 2028, shall meet or exceed the capability and performance requirements in the following sections of Institute of Electrical and Electronics Engineers (IEEE) 2800-2022, Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems (“IEEE 2800-2022 standard”), including any intra-standard cross references or definitions, unless otherwise clarified, modified, or exempted in the Protocols, these Operating Guides, or the Planning Guide:

(a) IEEE 2800-2022 standard, section 5, Reactive power-voltage control requirements within the continuous operation region;

(b) IEEE 2800-2022 standard, section 7, Response to TS abnormal conditions; and

(c) IEEE 2800-2022 standard, section 9, Protection.

(3) All IBR plant requirements and all IBR unit requirements described in the IEEE 2800-2022 standard apply at the Point of Interconnection Bus (POIB) and the individual IBR unit terminal, respectively, unless otherwise clarified, modified, or exempted in the Protocols these Operating Guides, or the Planning Guide.

(4) An IBR, Type 1 WGR or Type 2 WGR with an original SGIA executed before September 1, 2024, that implements modifications complying with Section 2.9.1.2, as described in paragraph (1)(c) of Planning Guide Section 5.2.1 for which a GIM was initiated on or after September 1, 2024, that fully implements such modifications prior to January 1, 2028, is not required to meet or exceed the capability and performance requirements in sections 5, 7 and 9 of the IEEE 2800-2022. Any IBR modifications complying with Section 2.9.1.2, as described in paragraph (1)(c) of Planning Guide Section 5.2.1 for which a GIM was initiated either (i) on or after September 1, 2024 and are not fully implemented by January 1, 2028, or (ii) on or after January 1, 2028, do not qualify for the exception under this paragraph (4).

(5) If an IBR with an SGIA executed on or after September 1, 2024, cannot meet or exceed the capability and performance requirements in sections 5, 7 and 9 of the IEEE 2800-2022 standard by its synchronization date, the Resource Entity or IE may request a temporary extension to meet or exceed the capability and performance requirements in sections 5, 7, and 9 of the IEEE 2800-2022 standard by submitting an extension request demonstrating good cause.. During any temporary extension, the Resource Entity or IE shall maximize its ride-through capability as set forth in Section 2.11, Maximizing Ride-Though Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, within its known equipment limitations as soon as practicable. Any temporary extensions shall be minimized and not extend beyond December 31, 2028 or 24 months after the Commercial Operations Date, whichever is earlier, subject to any extension authorized by ERCOT for good cause. During the pendency of an ongoing extension request or ERCOT, Public Utility Commission of Texas (PUCT) or judicial appeal, the IBR, Type 1 WGR, or Type 2 WGR must meet its documented maximum capabilities provided to ERCOT as required by Section 2.11.

(6) The Resource Entity or IE for each IBR shall maximize the performance of its protection systems, controls, and other plant equipment (within equipment limitations) to meet and, if possible, exceed the capability and performance set forth in sections 5, 7 and 9 of the IEEE 2800-2022 standard. If an IBR with an SGIA executed prior to September 1, 2024, cannot fully meet the requirements of sections 5, 7, and 9 of the IEEE 2800-2022 standard, then the Resource Entity shall maximize the performance of its protection systems, controls, and other plant equipment (within equipment limitations) to achieve, as close as reasonably possible, the capability and performance set forth in sections 5, 7 and 9 of the IEEE 2800-2022 standard as soon as practicable. If an IBR with an SGIA executed after September 1, 2024 with a Commercial Operations Date prior to January 1, 2026, cannot fully meet the requirements of sections 5, 7, and 9 of the IEEE 2800-2022 standard, then the Resource Entity shall maximize the performance of its protection systems, controls, and other plant equipment (within equipment limitations) to achieve, as close as reasonably possible, the capability and performance set forth in sections 5, 7 and 9 of the IEEE 2800-2022 standard as soon as practicable but no later than June 1, 2026 or by its Commercial Operations Date, whichever is later.

(7) The addition of Load co-located with an IBR, Type 1 WGR or Type 2 WGR with an original SGIA executed prior to September 1, 2024, for which a GIM is initiated as described in paragraph (1)(c) of Planning Guide Section 5.2.1, will not trigger a change in ride-through requirements and the IBR, Type 1 WGR or Type 2 WGR shall continue to be subject to Section 2.9.1.2 unless the converters, inverters, supplemental dynamic reactive devices, or any other equipment that reduces frequency or voltage ride-through capability are materially modified or replaced to meet any reliability requirements because of the co-located Load, in which case the IBR, Type 1 WGR or Type 2 WGR shall be subject to Section 2.9.1.1.

***2.9.1.1 Preferred Voltage Ride-Through Requirements for Transmission-Connected*** ***Inverter-Based Resources (IBRs)***

(1) All IBRs subject to this subsection shall ride through the root-mean-square voltage conditions in Tables A or B below, as applicable, and the instantaneous phase voltage conditions in Table C below, as measured at the IBR’s POIB:

**Table A: Applicable to WGR IBRs**

|  |  |
| --- | --- |
| Root-Mean-Square Voltage  (p.u. of nominal) | Minimum Ride-Through Time  (seconds) |
| V > 1.20 | May ride-through or trip |
| 1.10 < V ≤ 1.20 | 1.0 |
| 0.90 ≤ V ≤ 1.10 | continuous |
| 0.70 ≤ V < 0.90 | 3.0 |
| 0.50 ≤ V < 0.70 | 2.5 |
| 0.25 ≤ V < 0.50 | 1.2 |
| V < 0.25 | 0.16 |

**Table B: Applicable to PhotoVoltaic Generation Resources (PVGRs) and ESR IBRs**

|  |  |
| --- | --- |
| Root-Mean-Square Voltage  (p.u. of nominal) | Minimum Ride-Through Time  (seconds) |
| V > 1.20 | May ride-through or trip |
| 1.10 < V ≤ 1.20 | 1.0 |
| 0.90 ≤ V ≤ 1.10 | continuous |
| 0.70 ≤ V < 0.90 | 6.0 |
| 0.50 ≤ V < 0.70 | 3.0 |
| 0.25 ≤ V < 0.50 | 1.2 |
| V < 0.25 | 0.32 |

The minimum ride-through time in Tables A and B for voltages below the continuous operating range is inclusive of any amount of time the POIB voltage is below the specified voltage range. In the event of multiple excursions, the minimum ride-through time in Tables A or B is a cumulative time over a ten-second time window.

**Table C: Applicable to all IBRs**

|  |  |
| --- | --- |
| Instantaneous Peak Phase-to-Phase or Phase-to-Ground Voltage  (p.u. of nominal instantaneous peak voltage) | Minimum Ride-Through Time  (milliseconds) |
| V > 1.80 | May ride-through or trip |
| 1.70 < V ≤ 1.80 | 0.2 |
| 1.60 < V ≤ 1.70 | 1.0 |
| 1.40 < V ≤ 1.60 | 3.0 |
| 1.20 < V ≤ 1.40 | 15.0 |

The instantaneous voltages in Table C above are the residual voltages with surge arrestors, if applied. During the conditions identified in Table C, an IBR should continue injecting current, but need not respond to the sub-cycle transient overvoltage. If required by equipment limitations, the IBR may operate in current blocking mode when instantaneous voltage exceeds 1.20 p.u. at the POIB. If the IBR operates in current blocking mode, it shall restart current exchange in less than or equal to five cycles following instantaneous voltage falling below, and remaining below, 1.2 p.u. at the POIB. In the event of multiple excursions, the minimum ride through time in Table C is a cumulative time over a one-minute time window.

(2) Nothing in paragraph (1) above shall be interpreted to require an IBR to trip for voltage conditions beyond those for which ride-through is required.

(3) If protection systems (including, but not limited to protection for over-/under-voltage, rate-of-change-of-frequency, anti-islanding, and phase angle jump) are installed and activated to trip the IBR, they shall enable the IBR to ride through voltage conditions beyond those defined in paragraph (1) above to the maximum level the equipment allows as set forth in Section 2.11, Maximizing Ride-Though Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs.

(4) An IBR shall inject electric current when required to ride-through voltage conditions. When the POIB voltage is outside the continuous operating voltage range, an IBR shall continue to deliver pre-disturbance active current unless reduction is needed to allow for voltage support or otherwise specified by ERCOT or the interconnecting TSP. Any necessary reductions in active current to prioritize reactive current shall be relative to the voltage change at the POIB. Typically, more aggressive reductions in active current to allow for additional reactive current (if needed to stay within its current limitations) will occur at lower voltages (e.g., 0.4 p.u. or lower) but settings should be made based on the local needs of the ERCOT System where the IBR interconnects and ensures sufficient active current is available for protection system sensing. An IBR shall return to its pre-disturbance level of real power injection as soon as possible but no more than one second after POIB voltage recovers to normal operating range. ERCOT, in its reasonable discretion, may allow slower real power injection recovery rates if necessary for reliability as determined by the impacted TSP or ERCOT, or if required based on physical limitations of the IBR.

(5) IBR plant controls, turbine controls, and/or inverter controls shall not disconnect the IBR from the ERCOT Transmission Grid during voltage conditions where ride-through is required unless necessary to protect equipment from damage. IBR plant controls, turbine controls and/or inverter controls shall not reduce IBR output during voltage conditions requiring ride-through unless necessary to provide appropriate frequency response or dynamic Reactive Power support.

(6) If instantaneous over-current or over-voltage protection systems are installed and activated to trip the IBR, they shall use filtered quantities or time delays to prevent misoperation while providing the desired equipment protection. Any instantaneous over-voltage protection that could disrupt IBR power output shall use a measurement window of at least one cycle of fundamental frequency.

(7) The IBR shall ride through multiple excursions outside the continuous operation range in Tables A or B in paragraph (1) above as applicable, unless the conditions and situations specified below exist, in which case the IBR may trip to protect equipment from the cumulative effect of successive voltage deviations:

(a) More than four voltage deviations at the POIB outside the continuous operation range within any ten second period;

(b) More than six voltage deviations at the POIB outside the continuous operation range within any 120 second period;

(c) More than ten voltage deviations at the POIB outside the continuous operation range within any 1,800 second period;

(d) Voltage deviations outside of continuous operation range following the end of a previous deviation outside of continuous operation range by less than 20 cycles of system fundamental frequency;

(e) More than two individual voltage deviations at the POIB below 50% of the nominal voltage (including zero voltage) within any ten second period;

(f) More than three individual voltage deviations at the POIB below 50% of the nominal voltage (including zero voltage) within any 120 second period; or

(g) A WGR may trip for consecutive voltage deviations resulting in stimulation of mechanical resonances exceeding equipment limits.

Individual voltage deviations begin when the voltage at the POIB drops below the lower limit of the continuous operation range or exceeds the upper limit of the continuous operation range. Individual voltage deviations end when the root-mean-square voltage magnitude at the POIB, for the previous one-cycle period of fundamental frequency, returns to the continuous operation region.

(8) An IBR subject to this Section shall ride-through any fault disturbance where the POIB voltage remains within the ride-through profiles specified in paragraph (1) above. Measurements of quantities such as phase angle jump and rate-of-change-of-frequency during fault conditions are not meaningful and shall not be used to trip or reduce the output of the IBR during fault conditions.

(9) The Resource Entity or IE for each IBR subject to this Section shall set the IBR’s voltage ride-through capability to the maximum level equipment allows, as set forth in Section 2.11, to meet or exceed the requirements of paragraphs (1) through (8) above. A Resource Entity or IE may request an extension for modifications to confirm capability specified in paragraph (7) above by following the extension process set forth in paragraph (11). The Resource Entity or IE shall maximize the rate-of-change-of-frequency, phase angle jump and multiple excursion ride-through capability within known equipment limitations as set forth in Section 2.11.

(10) The Resource Entity of a Type 3 WGR that is subject to this Section may seek an extension from meeting the voltage ride-through performance Tables A and C in paragraph (1) above by following the extension process set forth in paragraph (11) below. Temporary extensions for performance of IBRs subject to this Section that do not meet the voltage ride-through performance in Table A in paragraph (1) of Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, are not allowed. During any such extension, the Resource Entity shall ensure the WGR’s voltage ride-through capability is set to the maximum level the equipment allows as set forth in Section 2.11.

(11) Any temporary extension requests under paragraphs (9) or(10) above shall be submitted with a demonstration of good cause, and subject to this Section, shall be minimized and not extend beyond December 31, 2028. During the pendency of an ongoing extension request or ERCOT, PUCT or judicial appeal, the IBR, Type 1 WGR, or Type 2 WGR must meet its documented maximum capabilities provided to ERCOT as required by Section 2.11.

(12) If the Resource Entity of an IBR subject to this Section identifies a possibility that the IBR did not ride-through in accordance with the applicable voltage ride-through requirements, the Resource Entity shall take actions described in Section 2.12, Actions of a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Does Not Ride Through.

***2.9.1.2*** ***Legacy Voltage Ride-Through Requirements for Transmission-Connected*** ***Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs)and Type 2 WGRs***

(1) All IBRs, Type 1 WGRs and Type 2 WGRs subject to this Section in accordance with paragraph (1)(b) of Section 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, shall ride through the root-mean-square voltage conditions in Table A below as measured at the Resource’s POIB:

**Table A**

|  |  |
| --- | --- |
| Root-Mean-Square Voltage  (p.u. of nominal) | Minimum Ride-Through Time  (seconds) |
| V > 1.20 | May ride-through or may trip |
| 1.175 < V ≤ 1.2 | 0.2 |
| 1.15 < V ≤ 1.175 | 0.5 |
| 1.10 < V ≤ 1.15 | 1.0 |
| 0.90 ≤ V ≤ 1.10 | continuous |
| 0.0 < V < 0.90 | (V+0.084375)/0.5625 |
| V = 0.0 | 0.15 |

For voltage between zero and 0.9 p.u. the minimum ride-through time in Table A above is defined by a straight line mathematical function where the duration is 0.15 seconds at zero voltage and 1.75 seconds at 0.9 p.u. voltage.

(2) Nothing in paragraph (1) above shall be interpreted to require an IBR or Type 1 WGR or Type 2 WGR to trip for voltage conditions beyond those for which ride-through is required.

(3) If protection systems (including, but not limited to protection for over-/under-voltage, rate-of-change-of-frequency, anti-islanding, and phase angle jump) are installed and activated to trip the IBR, Type 1 WGR or Type 2 WGR, they shall enable the IBR, Type 1 WGR or Type 2 WGR to ride through voltage conditions beyond those defined in paragraph (1) above to the maximum level the equipment allows as set forth in Section 2.11, Maximizing Ride-Though Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs..

(4) An IBR, Type 1 WGR or Type 2 WGR shall inject electric current when required to ride-through voltage conditions. When the POIB voltage is outside the continuous operating voltage range, an IBR shall continue to deliver pre-disturbance active current unless reduction is needed for voltage support or otherwise specified by ERCOT or the interconnecting TSP. Any necessary reductions in active current to prioritize reactive current shall be relative to the voltage change at the POIB. Typically, more aggressive reductions in active current to allow for additional reactive current (if needed to stay within its current limitations) will occur at lower voltages (e.g., 0.4 p.u. or lower) but settings shall be based on the local needs of the area of the ERCOT System to which the IBR interconnects and ensure sufficient active current is available for protection system sensing. An IBR, Type 1 WGR or Type 2 WGR shall return to its pre-disturbance level of real power injection as soon as possible but no more than one second after POIB voltage recovers to normal operating range. Slower real power injection recovery rates may be allowed if necessary for reliability as documented by the impacted TSP or ERCOT, or if required based on physical limitations of the IBR.

(5) IBR, Type 1 WGR, and Type 2 WGR plant controls, turbine controls, and/or inverter controls shall not disconnect the Resource from the ERCOT Transmission Grid during voltage conditions where ride-through is required. IBR, Type 1 WGR, and Type 2 WGR plant controls, turbine controls, and/or inverter controls shall not reduce the Resource’s output during voltage conditions requiring ride-through unless necessary for providing appropriate frequency response or dynamic Reactive Power support.

(6) If instantaneous over-current or over-voltage protection systems are installed and activated to trip the IBR or Type 1 WGR or Type 2 WGR, they shall use filtered quantities or sufficient time delays to prevent misoperation while providing the desired equipment protection. Any instantaneous over-voltage protection that could disrupt power output shall use a measurement period of at least one cycle (of fundamental frequency).

(7) Any IBR, Type 1 WGR or Type 2 WGR that monitors and actively protects against multiple excursions shall ensure its parameters to ride-through multiple voltage excursions are set to the maximum level the equipment allows as set forth in Section 2.11, to meet or exceed the requirements in paragraph (7) of Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), as soon as practicable but no later than June 1, 2026.

(8) Unless unable to modify with technically feasible and available software, settings, firmware, and parameterization changes, an IBR, Type 1 WGR or Type 2 WGR shall not use measurements of quantities such as phase angle jump and rate-of-change-of-frequency to trip or reduce the output of the Resource during fault conditions where the POIB voltage remains within the ride-through profiles specified in paragraph (1) above.

(9) The Resource Entity for each IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to September 1, 2024, shall ensure the Resource’s voltage ride-through capability is set to the maximum level the equipment allows, as set forth in Section 2.11.

(10) If an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to September 1, 2024 is unable fully meet the provisions of paragraphs (1) through (8) above through maximization of technically feasible and available software, settings, firmware, and parameterization changes, as set forth in 2.11, the Resource Entity shall set the Resource’s voltage ride-through capability to the maximum level the equipment allows to achieve, as close as reasonably possible, the requirements in paragraphs (1) through (8) above as soon as practicable but no later than June 1, 2026 or by its Commercial Operations Date, whichever is later. These maximized capabilities shall be the applicable ride-through requirement for such facilities.

(11) Any IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to September 1, 2024 must comply with the voltage ride-through capability requirements in effect immediately prior to the effective date of this paragraph that are applicable to such Resource until such time as the Resource establishes new maximized standards as set forth in Section 2.11.

(12) If the Resource Entity of an IBR, Type 1 WGR or Type 2 WGR identifies a possibility that the Resource did not ride through the applicable voltage ride-through requirements, the Resource Entity shall take actions described in Section 2.12, Actions if a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Does Not Ride Through.



**2.11 Maximizing Ride-Though Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs**

1. The Resource Entity for a Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR shall set the Resource’s frequency and voltage ride-through capabilities to the maximum level the equipment allows to meet or exceed the frequency and voltage ride-through requirements set forth in Section 2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, and Section 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, as soon as practicable but no later than June 1, 2026 or the Resource’s Commercial Operations Date, whichever is later. However, if an IBR, Type 1 WGR or Type 2 WGR with an Standard Generation Interconnection Agreement (SGIA) executed prior to September 1, 2024, cannot fully meet the applicable frequency or voltage ride-through requirements in Section 2.6.2.1, or Section 2.9.1, the Resource Entity shall set the Resource’s ride-through capabilities to the maximum level the equipment allows to achieve, as close as reasonably possible, the applicable frequency and voltage ride-through requirements as soon as practicable but no later than June 1, 2026 or the Resource’s Commercial Operations Date, whichever is later.
2. The term “maximization” as used throughout this Section, Section 2.6.2, Frequency Ride-Through Requirements for Generation Resources and Energy Storage Resources, (including Section 2.6.2.1), Section 2.9, Voltage Ride-Through Requirements for Generation Resources and Energy Storage Resources, (including Sections 2.9.1, 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type I Wind-Powered Generation Resources (WGRs) and Type 2 WGRs), and Section 2.12, Actions if a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) and Type 2 WGR does not Ride-Through, means that the Resource Entity must make technically feasible and available software, settings, firmware, and parameterization changes to increase the frequency and voltage ride-through capabilities of the IBR, Type 1 WGR or Type 2 WGR to the maximum level the existing equipment allows while still preventing equipment damage or degradation and in accordance with Good Utility Practice, with limits provided by the equipment manufacturers, and consistent with the exercise of reasonable engineering judgment to apply safety or reliability margins to such limits.
3. The Resource Entity of an IBR, Type 1 WGR or Type 2 WGR shall, by June 1, 2025 (or later for any Resource that has not been approved to energize as of June 1, 2025), submit to ERCOT via the Resource Integration and Ongoing Operations (RIOO) system, or as otherwise directed by ERCOT in writing, a report with the following information to the extent such information is applicable and available or can be reasonably obtained:
   1. Current frequency and voltage ride-through capabilities in a format similar to the applicable tables in paragraph (1) of Section 2.6.2.1, paragraph (1) of Section 2.9.1.1, and paragraph (1) of Section 2.9.1.2;
   2. For an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to September 1, 2024, that cannot fully meet the frequency or voltage ride-through requirements in Section 2.6.2.1 or Section 2.9.1.2, the Resource Entity shall provide:

(i) The known frequency and/or voltage ride-through limitations of the IBR, Type 1 WGR or Type 2 WGR, along with a description of such imitations, as compared to the applicable requirements in paragraphs (1) through (5) of Section 2.6.2.1 and/or paragraphs (1) through (8) of Section 2.9.1.2;

(ii) For any documented technical limitation that can be accurately represented in a model: (i) a model accurately representing all technical limitations, or (ii) where such model is not available or reasonably obtainable by the time the report is submitted, a schedule for providing such a model as soon as practicable; and

(iii) A description of any limitation that cannot be accurately represented in a model;

* 1. Planned modifications that the Resource Entity will implement to maximize the frequency and voltage ride-through capabilities of the IBR, Type 1 WGR or Type 2 WGR to approach, meet, or exceed the frequency ride-through requirements in paragraphs (1) through (5) of Section 2.6.2.1 and the applicable voltage ride-through requirements in paragraphs (1) through (8) of Section 2.9.1.1 or paragraphs (1) through (8) of Section 2.9.1.2, along with a schedule for implementing such modifications; and
  2. Expected post-modification capability in a format similar to the applicable tables in paragraph (1) of Section 2.6.2.1, paragraph (1) of Section 2.9.1.1, and paragraph (1) of Section 2.9.1.2 and documentation of any expected remaining limitations following implementation of such modifications.

1. The Resource Entity for an IBR, Type 1 WGR or Type 2 WGR shall update the report described paragraph (3) above with any material changes as soon as practicable upon knowledge of such material changes.
2. The Resource Entity of an IBR, Type 1 WGR or Type 2 WGR shall, as soon as practicable but no later than June 1, 2026 (or by the Resource’s Commercial Operations Date if the Resource has not achieved its Commercial Operations Date as of June 1, 2026), submit to ERCOT via the RIOO system, or as otherwise directed by ERCOT in writing, a report with the following information to the extent such information is applicable and available or can be reasonably obtained:
   1. Current frequency and voltage ride-through capabilities in a format similar to the applicable tables in paragraph (1) of Section 2.6.2.1, paragraph (1) of Section 2.9.1.1, and paragraph (1) of Section 2.9.1.2;
   2. Any modifications made to maximize the Resource’s frequency and voltage ride-through capabilities, including a description of the new ride through capability, modifications made to maximize the Resource’s ride-through capabilities, and any remaining technical limitations;
   3. For an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to September 1, 2024 that cannot fully meet the frequency or voltage ride-through requirements in Section 2.6.2.1 or Section 2.9.1.2, the Resource Entity shall provide:

(i) Known frequency or voltage ride-through limitations of the IBR, Type 1 WGR or Type 2 WGR, along with a description of such limitations, as compared to the applicable requirements in paragraphs (1) through (5) of Section 2.6.2.1 and/or paragraphs (1) through (8) of Section 2.9.1.2;

(ii) For any documented technical limitation that can be accurately represented in a model: (i) a model accurately representing all technical limitations, or (ii) where such model is not available or reasonably obtainable by the time the report is submitted, a schedule for providing such a model as soon as practicable;

(iii) A description of any limitation that cannot be accurately represented in a model; and

* 1. An attestation signed by an officer or executive with authority to bind the Resource Entity affirming that the Resource has maximized its frequency and voltage ride-through capability with all technically feasible and available software, settings, firmware, and parameterization changes in accordance with Section 2.11.

**2.12** **Actions if a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Does Not Ride Through**

(1) Ride-through performance criteria are defined in Section 2.6.2.1, Frequency Ride-through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, and Section 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources and Type 2 WGRs. All Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs shall strive to meet or exceed the ride-through performance criteria and maximize equipment capabilities, as set forth in Section 2.11, Maximizing Ride-Through Capabilities for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs.

(2) If the Resource Entity of an IBR, Type 1 WGR or Type 2 WGR identifies that the Resource may not have met its ride-through obligations, it shall, as soon as practicable:

(a) Investigate the occurrence;

(b) Notify ERCOT of the event and provide ERCOT with information regarding the cause of the Resource’s potential failure/inability to meet its ride-through obligations; and

(c) Perform model validation and report the results to ERCOT.

(3) Following an occurrence where the Resource does not ride through a disturbance, Transmission Service Providers (TSPs) that are directly impacted shall provide available information to ERCOT to assist with required analysis.

(4) Should ERCOT determine that an IBR, Type 1 WGR or Type 2 WGR failed to satisfy its ride-through performance requirements, it will notify the Resource Entity and require the Resource Entity to develop a mitigation plan.

(5) If ERCOT notifies the Resource Entity that a mitigation plan is necessary, the Resource Entity shall:

(a) Develop a plan to ensure the IBR, Type 1 WGR, or Type 2 WGR meets the applicable ride-through performance requirements including any modifications required to maximize its ride-through capability as set forth in Section 2.11;

(b) Submit the plan to ERCOT for approval within 90 days of ERCOT’s notification to the Resource Entity; and

(c) Upon ERCOT approval of the mitigation plan, implement the plan within 180 days, unless ERCOT approves a longer implementation timeline.

(6) The implementation of a mitigation plan under this Section shall satisfy the Resource Entity’s compliance obligations with regard to the failure to meet its maximized ride-through capabilities that are above the otherwise applicable ride-through requirements.