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| **NOGRR Number** | [**245**](https://www.ercot.com/mktrules/issues/NOGRR245) | **NOGRR Title** | **Inverter-Based Resource (IBR) Ride-Through Requirements** |

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| **Date** | June 5, 2024 |

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| **Submitter’s Information** | |
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| **Market Segment** | Not applicable |

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| **Comments** |

ERCOT submits these comments to address reliability concerns with the version of NOGRR245 that TAC voted to recommend on 3/27/24. These comments are responsive to stakeholder concerns identified at recent TAC meetings to the extent possible, and align with sentiments expressed by the ERCOT Board and Public Utility Commission of Texas (PUCT).

The reliability concerns and direction from the ERCOT Board and PUCT these comments seek to address were the focus of TAC meetings in May and June.

* Provides clarity and consistency of maximization up to equipment limitations and not just the performance requirements.
* Modifies the exemption process to:
  + Allow system reliability impacts to be included as a consideration for granting exemptions;
  + Not allow exemptions for unknown or phase angle jump or rate-of-change-of-frequency uncertainties;
  + Provide an objective, repeatable, criteria for cost thresholds for physical upgrades;
  + Maintain clear performance requirements during the exemption and appeal process; and
  + Give ERCOT sufficient time to review exemptions and appeals.
* Removes allowance for continued lowering of requirements through additional exemptions.
* Requires performance failures to be mitigated.
* Ensures that new Inverter-Based Resources (IBRs) will design and utilize the capabilities of modern IBRs to improve reliability performance.
* Makes voltage ride-through performance below .25 p.u. for new IBRs consistent with current requirements.

To address these reliability concerns, these comments:

* Modifies the Standard Generation Interconnection Agreement (SGIA) date for the applicability of “preferred ride-through” and certain IEEE 2800-2022 requirements from 6/1/23 to 8/1/24. This compromise is offered based on what some TAC members proposed and is dependent on requiring all IBRs to maximize their capabilities with respect to ride-through and the requirements of sections 5, 7, and 9 of the IEEE 2800-2022 standard (within existing equipment limitations). While ERCOT is hopeful this will offset reliability risk associated with further delaying the applicability of preferred ride-through requirements, ERCOT still has concerns that this may result in IBR plant design choices that will not utilize new inverter capabilities potentially up to 30 GWs of new IBRs with an SGIA between 6/1/23 to 8/1/24. However, ERCOT viewed this as a reasonable compromise if developers actually design and configure new plants to utilize these better capabilities despite not being required to perform to them.
* Establishes an exemption process that allows ERCOT to consider system reliability impacts instead of requiring exemptions be granted exclusively based on the commercial impacts to the requesting entity.
* Replaces “commercially reasonable” terminology with an objective, repeatable cost impact threshold and clarifies the types of physical improvements that should be considered if available. ERCOT proposes a cost threshold of 40% of replacement cost as it took into account ERCOT Board direction to consider reliability impact of a major event. TAC may consider an alternative threshold with justification in terms of avoiding the cost of a major event up to a complete system blackout which is the risk that NOGRR 245 is attempting to prevent.
* Provides ERCOT sufficient time to review exemptions and appeals since there may be hundreds of exemption requests that must be reviewed individually and at an aggregate level.
* Disallows exemptions for unknown or unverified capabilities such as phase angle jump and rate-of-change-of-frequency.
* Ensures performance failures do not result in further lowering an IBRs’ requirements and requires performance failures be mitigated. Mitigation provisions are clarified to be required up to requirement capabilities that exceed performance requirements when a performance failure occurs beyond performance requirements and below modeled, maximized ride-through capabilities.
* Ensures new Resources will be required to ride though voltages less than 0.25 p.u. similar to legacy IBRs rather than lowering such requirements for new Resources.
* Makes other enhancements to improve consistency and adds clarification.

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| **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), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 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, Ride-Through Reporting Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs (new)  2.11.1, Initial Frequency Ride-Through Capability Documentation and Reporting Requirements (new)  2.11.2, Initial Voltage Ride-Through Capability Documentation and Reporting Requirements (new)  2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions, and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs (new)  2.12.1, Exemptions and Extensions Process (new)  2.12.1.1, Submission of Exemption Requests (new)  2.12.1.2, Submission of Extension Requests (new)  2.12.1.3, Timeline for Submission and Determination of Exemption and Extension Requests (new)  2.12.1.4, Procedure for Appealing an ERCOT Decision to Reject an Exemption or Extension Request (new)  2.13, Actions Following a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Apparent Failure to Ride-through (new) |
| **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 IBRs and Type 1 and Type 2 WGRs 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 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. Additionally, due to Type 1 and 2 WGRs failing to ride through normal system disturbances, ERCOT proposes to apply several of the new requirements to these Resources. 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. As such, this NOGRR does not propose to grandfather existing IBRs and Type 1 and Type 2 WGRs indefinitely. Rather, this NOGRR proposes that all IBRs and Type 1 and Type 2 WGRs with a Standard Generation Interconnection Agreement (SGIA) executed prior to August 1, 2024 (“existing IBRs”), maximize ride-through capability to meet or exceed the new voltage ride-through profile and the new frequency ride-through profile as soon as practicable with all available and known commercially reasonable upgrades. IBRs and Type 1 and Type 2 WGRs that cannot meet the new ride-through requirements will need to submit a report by April 1, 2025 documenting such and provide a report to give ERCOT an accurate understanding of the physical limitations and maximum ride-through capability. An IBR or Type 1 WGR or Type 2 WGR that will be replaced or retrofitted and has documented technical exemptions granted, must meet the latest IEEE 2800 standard and preferred voltage ride-through requirements and will no longer be granted exemptions.  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. 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. |

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| **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 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, 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 responsibility to protect Generation Resources or ESRs from damaging operating conditions. 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.

(4) An IBR, 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 2 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 output during frequency conditions requiring ride-through unless necessary for providing appropriate frequency response.

(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 to meet or exceed the requirements of paragraphs (1) through (5) above as soon as practicable but no later than December 31, 2025 or at the time of its synchronization with the ERCOT Transmission Grid for new IBRs synchronizing after December 31, 2025.



(7) If an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to August 1, 2024 cannot comply with paragraphs (1) through (6) above by December 31, 2025, the Resource Entity or IE shall, by April 1, 2025, request an exemption pursuant to Section 2.11, Ride-Through Reporting Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs.

(8) 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 the actions described in Section 2.13, Actions Following a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Apparent Failure to Ride-Through.



***2.6.2.1.1*** ***Temporary 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 IBRs, Type 1 WGRs and Type 2 WGRs with an SGIA executed prior to August 1, 2024 that have not implemented modifications to satisfy paragraphs (1) through (5) of 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.

(2) Such Resources shall ride through the frequency conditions at the POIB specified in the following table:

|  |  |
| --- | --- |
| **Frequency Range** | **Delay to Trip** |
| 61.8 Hz or above | No time delay required |
| Below 61.8 Hz down to and including 61.6 Hz | Not less than 30 seconds |
| Below 61.6 Hz down to and including 60.6 Hz | Not less than 9 minutes |
| Above 59.4 Hz up to 60.6 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 |



(3) This Section shall not affect the Resource Entity’s responsibility to protect equipment from damaging operating conditions. The Resource Entity for an IBR, Type 1 WGR or Type 2 WGR subject to paragraph (2) above that is unable to remain reliably connected to the ERCOT Transmission Grid as set forth in paragraph (2), shall provide to ERCOT the information required in Section 2.11, Ride-Through Reporting Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs.















***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.

(4) Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, does not apply to exemptions to frequency ride-through requirements for DGRs and DESRs.

**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) and 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 August 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 August 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 August 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 August 1, 2024, 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) Section 5, Reactive power-voltage control requirements within the continuous operation region;

(b) Section 7, Response to TS abnormal conditions; and

(c) Section 9, Protection.

(3) All IBR plant requirements and 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 August 1, 2024, that implements modifications complying with Section 2.9.1.2 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 standard. Any IBR modifications implemented on or after January 1, 2028 do not qualify for this exception.

(5) If a Type 3 WGR with an original SGIA executed before August 1, 2024, cannot fully meet the requirements in Table 11 of the IEEE 2800-2022 standard and implements a modification as described in paragraph (1)(c) of Planning Guide Section 5.2.1, for which upgrades to equipment or facilities under a GIM are completed, the Resource Entity may request an exemption from meeting the voltage ride-through requirements in Table 11 of the IEEE 2800-2022 standard pursuant to Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2WGRs.

(6) If an IBR with an SGIA executed on or after August 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 those requirements by submitting an extension request pursuant to Section 2.12. Any temporary extensions shall be minimized and not extend beyond December 31, 2028 or 24 months after the Commercial Operations Date, whichever is earlier.

(7) Type 1 and Type 2 WGRs are not required to meet or exceed the capability and performance requirements in sections 5, 7 and 9 of the IEEE 2800-2022 standard but must meet or exceed the capability and performance requirements in Section 2.9.1.2 unless an extension or exemption applies under this Section or Section 2.12.

(8) 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 [DATE] cannot fully meet the requirements of sections 5, 7, and 9 of the IEEE 2800-2022 standard, 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 December 31, 2025 or by its Commercial Operations Date, whichever is later.

(9) The addition of co-located Load as a modification, as described in paragraph (1)(c) of Planning Guide Section 5.2.1, for which a GIM was initiated, shall not trigger a change in ride-through requirements so long as the IBR, Type 1 WGR or Type 2 WGR has an original SGIA executed prior to August 1, 2024 unless the converters, inverters, supplemental dynamic reactive devices, or any other equipment that alters 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 Resource Entity shall continue to be subject to Section 2.9.1.2.

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

(1) All IBRs subject to this Section 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 |
| 0.005625 ≤ V < 0.25 | 0.16(V+0.084375)/0.5625 |
| V < 0.005625 | 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 |
| 0.095625 ≤ V < 0.25 | 0.32(V+0.084375)/0.5625 |
| V < 0.095625 | 0.32 |

The minimum ride-through time in Tables A and B for voltage 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. For voltage between 0.005625 p.u. and 0.25 p.u. in Table A above and 0.095625 p.u. and 0.25 p.u. in Table B above, the minimum ride-through time 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.

**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. If the applicable root-mean-square voltage thresholds identified in Tables A or B above are not exceeded, ride-through is required for any level of instantaneous voltage.

(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.

(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.

(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. IBR plant controls, turbine controls and/or inverter controls shall not reduce the IBR output during voltage conditions requiring ride-through unless necessary to provide appropriate frequency response.

(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.

Any IBR that monitors and actively protects against multiple excursions outside of the continuous operation range in Tables A and B in paragraph (1) above, shall ensure its parameters to ride-through multiple voltage excursions are set to the maximum level the equipment allows to meet and, if possible, exceed the performance requirements in paragraph (1) above. 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 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 shall maximize the performance of its protection systems, controls, and other plant equipment (within equipment limitations) to meet and, if possible, exceed the requirements of paragraphs (1) through (8) above. A Resource Entity or IE may request an extension for upgrades or retrofits to confirm capability specified in paragraph (7) above by following the extension process set forth in Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2WGRs. 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 soon as practicable. Any temporary extensions under this paragraph shall be minimized and not extend beyond December 31, 2028.

(10) A Resource Entity of a Type 3 WGR may seek an extension for completing modifications to meet the voltage ride-through performance Tables A and C in paragraph (1) above by following the extension process set forth in Section 2.12. During any extension, the Resource Entity shall ensure the WGR’s voltage ride-through capability is set to the maximum level the equipment allows as soon as practicable.

(11) Any temporary extensions for IBRs with SGIAs on or after August 1, 2024 shall be minimized and not extend beyond December 31, 2028. Temporary extensions for performance 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.

(12) If an IBR fails to perform in accordance with the applicable voltage ride-through requirements, the Resource Entity for the IBR shall take the actions described in Section 2.13, Actions Following a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Apparent Failure to 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) 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, 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.

(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.

(5) IBR, Type I 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.

(6) If instantaneous over-current or over-voltage protection systems are installed and activated to trip the IBR, 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) IBRs, Type 1 WGRs or Type 2 WGRs 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 Resource during fault conditions.

(8) The Resource Entity for each IBR, Type 1 WGR or Type 2 WGR shall maximize the performance of its protection systems, controls, and other plant equipment (within equipment limitations) to meet and, if possible, exceed the performance requirements in paragraphs (1) through (7) above as soon as practicable but no later than December 31, 2025 or by its Commercial Operations Date, whichever is later.

(9) If an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to August 1, 2024 cannot comply with paragraphs (1) through (8) above by December 31, 2025, the Resource Entity shall, by April 1, 2025, request an exemption pursuant to Section 2.12.

(10) If an IBR, Type 1 WGR or Type 2 WGR fails to perform in accordance with the applicable voltage ride-through requirements, the Resource Entity shall take the actions described in Section 2.13, Actions Following a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Apparent Failure to Ride-Through.



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

***2.11.1*** ***Initial Frequency Ride-Through Capability Documentation and Reporting Requirements***

(1) The Resource Entity of an Inverter-Based Resource (IBR), Type 1 Wind-powered Generation Resource (WGR) or Type 2 WGR with a Standard Generation Interconnection Agreement (SGIA) executed prior to August 1, 2024 that cannot comply with paragraphs (1) through (6) of 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 by December 31, 2025 shall, by April 1, 2025, submit to ERCOT via the Resource Integration and Ongoing Operations (RIOO) system, or as otherwise directed by ERCOT, a report with supporting information or documentation and request an exemption or extension containing the following:

(a) Current frequency ride-through capability in a format similar to the table in paragraph (1) of Section 2.6.2.1;

(b) Known frequency ride-through limitations of the IBR, Type 1 WGR or Type 2 WGR as compared to the requirements in paragraphs (1) through (5) of Section 2.6.2.1;

(c) For known and available technically feasible modifications evaluated by the Resource Entity to meet the applicable ride-through requirements, the cost of implementing the modification(s) to meet the applicable ride-through requirement(s) on a per inverter or turbine basis. ERCOT will treat all financial and proprietary information provided under this Section or Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, as Protected Information;

(d) Modifications the Resource Entity will implement to maximize the frequency ride-through capability of the IBR, Type 1 WGR or Type 2 WGR within known equipment limitations, to the greatest extent possible;

(e) Expected post-modification Resource capability in a format similar to the table in paragraph (1) of Section 2.6.2.1 and documentation of any expected remaining limitation(s) following implementation of such modifications;

(f) A schedule for implementing the modification(s);

(g) 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 the model as soon as practicable; and

(h) A description of any limitation that cannot be accurately represented in a model.

***2.11.2*** ***Initial Voltage Ride-Through Capability Documentation and Reporting Requirements***

(1) The Resource Entity of an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to August 1, 2024, that cannot comply with paragraphs (1) through (9) 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 by December 31, 2025 shall, by April 1, 2025, submit to ERCOT via the RIOO system, or as otherwise directed by ERCOT, a report with supporting information or documentation and request an exemption or extension containing the following:

(a) Current voltage ride-through capability in a format similar to the table in paragraph (1) of Section 2.9.1.2;

(b) Known voltage ride-through limitations of the IBR, Type 1 WGR or Type 2 WGR as compared to the requirements in paragraphs (1) through (9) of Section 2.9.1.2;

(c) For known and available technically feasible modifications evaluated by the Resource Entity to meet the applicable ride-through requirements, the cost of implementing the modification(s) to meet the applicable ride-through requirement(s) on a per inverter or turbine basis. ERCOT will treat all financial and proprietary information provided under this Section or Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, as Protected Information;

(d) Modifications the Resource Entity will implement to maximize the voltage ride-through capability of the IBR, Type 1 WGR or Type 2 WGR to approach or meet the voltage ride-through requirements in paragraphs (1) through (9) of Section 2.9.1.2 within known equipment limitations, to the greatest extent possible;

(e) Expected post-modification Resource capability in a format similar to the table in paragraph (1) of Section 2.9.1.2 and documentation of any expected remaining limitation(s) following implementation of such modifications;

(f) A schedule for implementing the modification(s);

(g) 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

(h) A description of any limitation that cannot be accurately represented in a model.

**2.12** **Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs**

***2.12.1******Exemptions and Extensions Process***

(1) If an Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR has a technical limitation preventing it from fully meeting the frequency ride-through requirements in paragraphs (1) through (5) of 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, or the voltage ride-through requirements in paragraphs (1) through (8) 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; or as otherwise specified in paragraphs (5) through (7) 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, or certain voltage ride-through requirements in accordance with paragraph (10) of Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), the Resource Entity or Interconnecting Entity (IE) (“Requesting Entity”) may request from ERCOT, under this Section, an exemption from meeting, or extension to meet, such applicable requirements.

(2) For any IBR, Type 1 WGR or Type 2 WGR with a Standard Generation Interconnection Agreement (SGIA) dated before August 1, 2024, exemption requests must be submitted to ERCOT on or before April 1, 2025.

(3) When seeking an exemption, a Requesting Entity shall provide to ERCOT:

(a) A detailed description of the technical limitation preventing the Resource from meeting the ride-through requirement(s), including a letter signed by an officer or executive of the original equipment manufacturer (or subsequent support company if the original equipment manufacturer is no longer in business) or an engineering consulting firm verifying the need for an exemption;

(b) Documentation describing any technically feasible modifications the Requesting Entity has implemented or will implement to meet the requirements;

(c) Documentation describing any technically feasible modification(s) the Requesting Entity will not implement due to being cost prohibitive;

(d) Models that accurately represent expected performance reflecting the technical limitations before and after any modifications to improve performance, including a description of any limitation that cannot be accurately represented in a model;

(e) The cost of implementing each technically feasible Resource modification or upgrade to meet the applicable ride-through requirement(s) on a per inverter or turbine basis;

(f) The cost of full in-kind replacement for all inverters or turbines/converters in the plant; and

(g) Any other financial information the Resource Entity believes ERCOT should consider.

(4) When determining whether to grant an exemption, ERCOT will, in its sole and reasonable discretion, grant the exemption unless one or more of the conditions below exists:

(a) The risk to ERCOT System reliability posed by the individually requested exemption/extension or, in aggregate, all requested exemptions/extensions are unacceptable to ERCOT. Unacceptable reliability risks include but are not limited to:

(i) Instability, cascading outages or uncontrolled separation;

(ii) Loss of generation capacity from multiple Resources equal to or greater than 500 MW;

(iii) Loss of Load equal to or greater than 75 MW;

(iv) Safety of or damage to neighboring equipment;

(v) Unknown or unverified limitation(s); or

(vi) Phase angle jump or rate-of-change-of-frequency tripping during faults.

(b) The Requesting Entity has not implemented all available software, firmware, settings or parameterization modifications to meet or provide material improvement to meeting the applicable ride-through requirements.

(c) The Requesting Entity has not implemented a technically feasible modification to meet or provide significant improvement to meet the applicable ride-through requirements where the cost to the Requesting Entity of upgrading or modifying the Resource is less than 40 percent of the cost of full in-kind replacement for all inverters or turbines/converters in the plant. Potential modifications to meet or provide material improvement to meet the applicable ride-through requirements include, but are not limited to, the following:

(i) Protection system upgrades or replacements;

(ii) Communication upgrades;

(iii) Controller card upgrade kits;

(iv) Component upgrades (e.g., DC chopper, Phase-Locked Loop (PLL) controller, vibration monitoring, DC controller, Uninterrupted Power Supply (UPS), etc.); or

(v) Plant equipment upgrades (transformers, dynamic reactive devices, etc.).

(5) ERCOT, in its sole and reasonable discretion, will grant an extension if all of the following conditions exist:

(a) Circumstances beyond the Requesting Entity’s reasonable control prevented it from meeting the deadline;

(b) The extension request demonstrates the Requesting Entity’s good faith efforts to minimize the extension’s duration;

(c) The Requesting Entity has provided accurate models that include all limitations and describes all limitations the Requesting Entity cannot model and represents to ERCOT the model is accurate;

(d) The date for the requested extension for a Resource with an SGIA before August 1, 2024 does not exceed December 31, 2027; and

(e) The date for the requested extension for a Resource with an SGIA after August 1, 2024 does not exceed December 31, 2028.

(6) For any IBR, Type 1 WGR or Type 2 WGR with an approved exemption or extension, the documented maximum capabilities will become the new performance requirements until the exemption or extension has ended.

(7) Exemptions and extensions under this Section take effect immediately upon approval by ERCOT and apply only to the extent approved by ERCOT.

(8) Exemptions under Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions, Extensions and Appeals for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, continue until:

(i) The IBR, Type 1 WGR or Type 2 WGR fully implements a modification as described in paragraph (1)(c) of Planning Guide Section 5.2.1, Applicability, that is synchronized after January 1, 2028, except for exemptions that continue as contemplated in paragraph (9) of Section 2.9.1;

(ii) If ERCOT determines one of the conditions described in paragraph (4)(a) above arises after ERCOT previously granted an exemption to a Resource, ERCOT may revoke that exemption; or

(iii) If ERCOT or the Resource Entity becomes aware of a new modification for a Resource with an exemption that is determined to not be cost prohibitive to implement, the Resource Entity shall: (i) submit an implementation plan to ERCOT for approval within 90 days, and (ii) if ERCOT approves the plan, implement the plan within 180 days, unless ERCOT approves a longer timeline.

(9) Extensions under Section 2.12 shall end in accordance with Section 2.12.1.2, Submission of Extension Requests.

(10) Except for the provisions of Section 2.12.1.1, Submission of Exemption Requests and Section 2.13.1.2, the deadlines in Section 2.12 may be modified by mutual written agreement of ERCOT and the Requesting Entity.

(11) During the pendency of an exemption, extension, or appeal process, the IBR, Type 1 WGR or Type 2 WGR that is the subject of the exemption or extension request is required to meet the greater of: (i) its documented maximum capability, or (ii) its performance requirements in effect on May 1, 2024 until there is a non-appealable Public Utility Commission of Texas (PUCT) final order. If ERCOT:

(a) Grants the exemption or extension, the documented maximum ride-through capability becomes the Resource’s compliance obligation; or

(b) Denies the exemption or extension and the Requesting Entity appeals ERCOT’s decision to the PUCT, the Resource’s compliance obligation shall be the greater of: (i) its documented maximum capability, or (ii) its performance requirements in effect on the day prior to August 1, 2024 until there is a non-appealable PUCT final order.

(12) ERCOT shall not refer to the Reliability Monitor any Requesting Entity’s request for an exemption or extension. ERCOT may refer to the Reliability Monitor for investigation, any performance failure of the IBR, Type 1 WGR or Type 2 WGR as contemplated Section in 2.13, Actions Following a Transmission-Connected Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR Apparent Failure to Ride-Through relating to frequency or voltage ride-through requirements.

(13) All information submitted under Section 2.12 shall be considered Protected Information.

***2.12.1.1 Submission of Exemption Requests***

(1) A Requesting Entity may seek an exemption for an IBR, Type 1 WGR or Type 2 WGR as follows:

(a) A Requesting Entity for an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to August 1, 2024 may seek exemptions from ride-through requirements in paragraphs (1) through (5) of 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 or 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.

(b) A Requesting Entity for a Type 3 WGR with an original SGIA executed prior to August 1, 2024, that meets the criteria in paragraph (5) 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, may seek an exemption as described in that Section.

(2) A Requesting Entity, through its Authorized Representative, may initiate a request for an exemption under this Section by submitting written notice of the request to ERCOT through the Resource Integration and Ongoing Operations (RIOO) system (or as otherwise specified by ERCOT), with the following information:

(a) Requesting Entity Name;

(b) Requesting Entity DUNS Number;

(c) IBR/WGR Site Name;

(d) IBR/WGR Unit Name(s);

(e) Nodal Operating Guide Section(s) under which the exemption is requested;

(f) A detailed description of the grounds for the exemption and the basis for each request;

(g) Documentation describing all known limitations associated with the exemption request;

(h) A statement from the equipment manufacturer supporting the need for the exemption; and

(i) Any remaining information required in the reports in Section 2.11, Ride-Through Reporting Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, applicable to the request or paragraph (2) of Section 2.12.1, Exemptions and Extensions Process.

***2.12.1.2 Submission of Extension Requests***

(1) A Requesting Entity may seek an extension for an IBR, Type 1 WGR or Type 2 WGR as follows:

(a) A Requesting Entity for an IBR, Type 1 WGR or Type 2 WGR with an SGIA executed prior to August 1, 2024, may seek extensions for ride-through requirements in paragraphs (1) through (5) of 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 or 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.

(b) A Requesting Entity for an IBR with an SGIA executed on or after August 1, 2024 may seek extensions as contemplated in paragraph (6) 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, paragraphs (9) or (10) of Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs).

(2) A Requesting Entity, through its Authorized Representative, may initiate a request for an extension under this Section by submitting written notice of the request to ERCOT through the RIOO system (or as otherwise specified by ERCOT), with the following information:

(a) Requesting Entity Name;

(b) Requesting Entity DUNS Number;

(c) IBR/WGR Site Name;

(d) IBR/WGR Unit Name(s);

(e) Nodal Operating Guide Section(s) under which the extension is requested;

(f) A detailed description of the grounds for the extension and the basis for each request;

(g) Documentation from the equipment manufacturer describing any known limitations associated with the extension request, a description of proposed modifications, and a schedule for implementing modifications; and

(h) Other information specified in this Section.

(3) The Requesting Entity for an IBR with an SGIA executed on or after August 1, 2024, seeking an extension contemplated in paragraph (6) of Section 2.9.1, or paragraph (10) of Section 2.9.1.1 shall, at a minimum, submit the following information to ERCOT:

(a) Documentation describing the justification for granting the extension;

(b) A model accurately representing all technical limitations and expected performance;

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

(d) Data and information identified in paragraphs (5) through (7) below, as applicable; and

(e) Any other data or information ERCOT reasonably deems necessary to evaluate granting the extension.

(5) If a Requesting Entity submits a request for an extension to meet the performance requirements in sections 5, 7, and 9 of the 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”) as described in paragraph (6) of Section 2.9.1, it must provide to ERCOT:

(a) Evidence from its original equipment manufacturer (or subsequent inverter/turbine vendor support company if the original equipment manufacturer is no longer in business) of technical infeasibility to comply with any of the performance requirements in sections 5, 7, and 9 of the IEEE 2800-2022 standard by its synchronization date;

(b) A description of proposed modifications; and

(c) The schedule for implementing those modifications. Any temporary extension shall be minimized and not extend beyond December 31, 2028 or 24 months after the Resource’s Commercial Operations Date, whichever is earlier.

(6) If a Requesting Entity submits a request for an extension to meet the performance requirements in paragraph (7) as contemplated in paragraph (9) of Section 2.9.1.1, it must provide to ERCOT:

(a) Evidence from its equipment manufacturer of technical infeasibility to comply with the performance requirements in paragraph (7) of Section 2.9.1.1 by its synchronization date;

(b) A description of proposed modifications; and

(c) The schedule for implementing those modifications. Any extensions under this paragraph shall be minimized and not extend beyond December 31, 2028.

(7) If a Requesting Entity submits a request for an extension to meeting the performance requirements in Tables A or C in paragraph (1) as contemplated in paragraph (10) of Section 2.9.1.1, it must provide to ERCOT:

(a) Documented evidence from its equipment manufacturer of technical infeasibility to comply with the performance requirements in paragraph (1) of Section 2.9.1.1 by the IBR’s/WGR’s synchronization date;

(b) A description of proposed modifications; and

(c) The schedule for implementing those modifications. Any extensions under this paragraph shall be minimized and not extend beyond December 31, 2028. ERCOT will not grant any temporary extensions for performance that do not meet the voltage ride-through performance requirements in Table A in paragraph (1) of Section 2.9.1.2.

(8) Extensions will terminate according to their terms at the time granted or at another date approved by ERCOT in writing.

***2.12.1.3 Timeline for Submission and Determination of Exemption and Extension Requests***

(1) As soon as practicable after receiving a request for an exemption or extension, ERCOT shall provide the Requesting Entity with written confirmation of receipt and notification that either:

(a) The submission was complete and ERCOT is reviewing the request; or

(b) The submission was incomplete. For incomplete submissions, ERCOT will:

(i) Identify the missing information; and

(ii) Provide instructions for the Requesting Entity to submit the missing information (e.g., to ERCOT Legal at [MPRegistration@ercot.com](mailto:MPRegistration@ercot.com) or through the RIOO system).

(2) Unless otherwise agreed by ERCOT, not later than ten Business Days of receiving a notice of an incomplete submission, the Requesting Entity shall submit the missing information to ERCOT through the RIOO system or as otherwise directed by ERCOT that it needs additional time to provide the additional information, along with an explanation for the delay.

(3) Within seven days after ERCOT acknowledges receiving a complete request for exemption or extension, ERCOT shall designate an ERCOT senior representative with decision-making authority to participate in discussions with the Requesting Entity regarding the exemption or extension request.

(4) During the time ERCOT considers an exemption or extension request, ERCOT and the Requesting Entity will cooperate in requesting and providing relevant information to develop a complete record to allow an effective and efficient review process.

(5) ERCOT shall make reasonable efforts to complete an exemption or extension request process within 180 days after receiving a complete request for an exemption or extension. If ERCOT cannot complete its review of the request within that time period, ERCOT shall provide the Requesting Entity an estimate of the additional time needed to complete its review. ERCOT shall provide the Requesting Entity with written notification that ERCOT has completed its review and ERCOT’s determination that the exemption or extension is:

(a) Approved;

(b) Approved in part, along with details of the approved part of the exemption or extension, and a detailed explanation for denying part of the exemption or extension request; or

(c) Rejected, along with details explaining the grounds upon which ERCOT rejected the exemption or extension request.

***2.12.1.4 Procedure for Appealing an ERCOT Decision to Reject an Exemption or Extension Request***

(1) Upon issuance of ERCOT’s decision on the exemption or extension request, the Requesting Entity adversely affected may appeal ERCOT’s decision to the Public Utility Commission of Texas (PUCT) pursuant to P.U.C. PROC. R. 22.251, Review of Electric Reliability Council of Texas (ERCOT) Conduct. For such an appeal, the Requesting Entity is not required to comply with Protocol Section 20, Alternative Dispute Resolution Procedure and Procedure for Return of Settlement Funds.

(2) A Requesting Entity that does not submit a notice of appeal to ERCOT within the required time period after receiving ERCOT’s notice rejecting the exemption or extension request is deemed to have accepted ERCOT’s decision.

***2.13*** ***Actions Following* *a Transmission-Connected******Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR)******or Type 2 WGR Apparent Failure to Ride-Through***

(1) The required ride-through performance criteria (“Required 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 (WGRs) and Type 2 WGRs. For any Inverter-Based Resource (IBR), Type 1 Wind-powered Generation Resource (WGR) or Type 2 WGR with an approved exemption or extension for the ride-through requirements, the Resource’s documented maximum ride-through capabilities are the ride-through performance requirements for compliance purposes for the duration of the exemption or extension unless otherwise indicated by Governmental Authority rules or regulations. All IBRs, Type 1 WGRs and Type 2 WGRs shall strive to meet or exceed the Required Criteria to the fullest extent their equipment allows.

(2) For any IBR, Type 1 WGR or Type 2 WGR with an approved exemption or extension for the ride-through requirements, the Resource’s documented maximum ride-through capabilities are the ride-through performance requirements for compliance purposes for the duration of the exemption or extension unless otherwise indicated by Governmental Authority rules or regulations. Any IBR with documented maximized ride-through capabilities that exceed the applicable Required Criteria and fails to ride-through a disturbance within the IBR’s documented maximized capabilities is also subject to this Section.

(3) If an IBR, Type 1 WGR or Type 2 WGR does not ride-through in accordance with the applicable ride-through performance requirements, including its maximized capabilities (an “Apparent Performance Failure”), the Resource Entity shall, as soon as practicable:

(a) Investigate the Apparent Performance Failure;

(b) Report to ERCOT the cause of the Apparent Performance Failure; and

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

(4) Following an Apparent Performance Failure, Transmission Service Providers (TSPs) directly impacted by the Apparent Performance Failure shall provide available information to ERCOT to assist with event analysis.

(5) The Resource Entity for an IBR, Type 1 WGR, or Type 2 WGR that experiences an Apparent Performance Failure shall:

(a) Develop a plan to ensure the IBR, Type 1 WGR, or Type 2 WGR meets the applicable ride-through performance requirements (whether documented maximized capability or Required Criteria, whichever applies);

(b) Submit the plan to ERCOT for approval within 90 days; and

(c) If ERCOT approves the plan, implement the plan within 180 days, unless ERCOT approves a longer timeline.

(6) To encourage all Resources to maximize all equipment frequency and voltage ride-through parameters to the maximum level the equipment allows and all new Resources to also design the plant to the utilize the inverter or converter capabilities to the fullest extent, any Apparent Performance Failure where system conditions at the Point of Interconnection Bus (POIB) exceeded the Required Criteria but remained below documented maximized frequency or voltage ride-through capabilities exceeding the applicable requirements in Sections 2.6.2, Frequency Ride-Through Requirements for Generation Resources and Energy Storage Resources, 2.9.1, 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) or 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 be reported to the Reliability Monitor only if the Resource Entity does not fully meet the requirements in paragraphs (3) and (5) above.