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| **NOGRR Number** | [**245**](https://www.ercot.com/mktrules/issues/NOGRR245) | **NOGRR Title** | **Inverter-Based Resource (IBR) Ride-Through Requirements** |
|  | |  | |
| **Date** | | August 12, 2024 | |

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

**Comments**

As indicated at the Reliability & Markets (R&M) Committee at its June 17, 2024 meeting, ERCOT staff requested tabling of Nodal Operating Guide Revision Request (NOGRR) 245 to work with Joint Commenters on concerns raised in their previously filed comments, including the exemption process for Type 1 and Type 2 Wind-powered Generation Resources (WGRs) and Inverter-Based Resources (IBRs) that would be subject to legacy frequency and voltage ride-through requirements. The R&M Committee recommended and the ERCOT Board of Directors (ERCOT Board) voted unanimously to table NOGRR245 to allow ERCOT to work with Joint Commenters on these concerns.

ERCOT staff met on several occasions with the Joint Commenters to work on language acceptable to all parties. In fact, even up to the last hours of filing these comments, ERCOT has tried to understand Joint Commenters myriad of concerns and accommodate appropriate changes in the NOGRR so long as it does not lower the reliability requirements.

The changes shown in these comments fall into essentially one of four categories:

1. Clarifications/to address Joint Commenter Concerns (“Category 1”)
2. Necessary to address the bifurcation of this NOGRR and a subsequent NOGRR to develop criteria for granting exemptions (“Category 2”)
3. To correct errors (“Category 3”)
4. To remove redundant language (“Category 4”).

Although there are extensive redlines from the June 7, 2024, TAC-recommended version of NOGRR245, the core fundamental benefits of the NOGRR are retained in ERCOT’s recommended version. These critical pieces were noted in ERCOT’s June 16, 2024, comments to the R&M Committee.

Below in the section titled “Summary Explanation for Each Category Change,” ERCOT provides a brief explanation and justification for the proposed revisions to each section noting the Category Number from above. ERCOT hosted a WebEx with interested stakeholders on August 8, 2024, to inform them of the majority of these changes and receive any additional input.

For the bifurcation or decoupling of the exemption process in this NOGRR to be successful, ERCOT requests the R&M Committee recommend and the ERCOT Board designate the subsequent NOGRR as a Board Priority Revision Request to be considered by the ERCOT Board no later than its February 2025 meeting. ERCOT further requests the ERCOT Board instruct TAC to provide updates at future R&M Committee/Board meetings on the progress of the Revision Request, including any identified issues that put the timeline in jeopardy. The subsequent NOGRR would be expected to address more details around the exemption process (including the ability to supplement information if the Resource Entity made the April 1, 2025 exemption request), appropriate criteria for some level of hardware upgrades to meet relevant ride-through performance requirements for their vintage of Resource or whether that Resource would be granted an exemption, and details about the reliability assessment process. ERCOT cannot anticipate any other additional items that may be raised by stakeholders or the likely success of getting consensus on the subsequent NOGRR.

ERCOT once again would like to express its sincere appreciation of the work done by the stakeholders, including TAC, on this critically important reliability policy that will enhance reliability on ride-through performance over time. ERCOT requests the R&M Committee recommend and the ERCOT Board approve the June 7, 2024 TAC Report as modified by the August 12, 2024 ERCOT Comments.

**Summary Explanation for Each Category Change**

* Category 1: Sections 2.6.2.1(4); 2.9.1.1(4); 2.9.1.2(4) Revised based on Joint Commenters’ request to make it clear the requirement does not apply when output reductions occur due to wind speed or solar irradiance changes (language taken from NERC Reliability Standard PRC-030)
* Category 1: Sections 2.6.2.1(5); 2.9.1.1(5); 2.9.1.2(5) Revised to address Joint Commenters’ concern about the phrase “power output”
* Category 1: Section 2.6.2.1(6) Revised to:
  + make it clear ERCOT must know the date on which the Resource maximized its ride-through capability (for modelling purposes);
  + define how to determine whether a Resource “maximized” its ride-through capability to its equipment limits; and
  + add “Good Utility Practice” per Joint Commenters’ request
* Category 2/1: Section 2.6.2.1(7) Resources will submit the Initial Frequency Ride-Through Capability Report (IFRTCR) and request an exemption by 4/1/25 but the *criteria* for exemptions will be established in a new NOGRR and, while ERCOT currently has the authority to impose operational restrictions (even without an exemption request), it is better to clarify that Resources do not “automatically” receive an exemption by submitting the IFRTCR
* Category 1: Section 2.9.1(5) Clarifies date by which modifications must be completed
* Category 1: Section 2.9.1(8) Clarifies that ERCOT must know when the Resource maximized ride-through capability (for modelling - as in Section 2.6.2.1(6), above)
* Category 3/4: Section 2.9.1.1(1) Corrects typographical errors in the formulae in Tables A & B and removed Table C because it contains the same requirements set forth in IEEE 2800-2022 Section 7.2.3
* Category 4: Section 2.9.1.1(7) Deleted because requirement is covered in Section 7.2.2.4 of IEEE 2800-2022
* Category 4: Section 2.9.1.1(8) Changes number to (7) and removes the first sentence, which was redundant to paragraph (1) that already requires ride-through during disturbances regardless of other equipment failures related to phase angle or rate-of-change-of-frequency (RoCoF)
* Category 1: Renumbered Section 2.9.1.1(7) Reworded (second sentence) to provide additional clarity by including the fault *and* recovery period
* Category 3: Renumbered Section 2.9.1.1(8) Corrects paragraph numbers due to deletion of original Section 2.9.1.1(7) and to make it clear Resource Entities (REs) must complete ride-through maximization activities by 12/31/25
* Category 4: Renumbered Section 2.9.1.1(8) Penultimate sentence removed because the topic is covered in Section 2.9.1, which requires maximization to meet or exceed IEEE 2800-2022
* Category 4: Renumbered Section 2.9.1.1(9) Revised due to removal of Table C
* Categories 1 and 4: Section 2.9.1.2(7) Revised similar to 2.9.1.1(7):
  + First sentence is redundant to paragraph (1), which already requires ride-through during disturbances regardless of other equipment failures related to phase angle or RoCoF
  + The second sentence provides additional clarity to include the period of the fault and recovery period
* Category 1: Section 2.9.1.2(9) Address situations where Resource cannot meet the 12/31/25 deadline to maximize ride-through capability
* Category 1: Section 2.11 Adds three new sub-sections to clarify the Resource Entity must tell ERCOT if it considers a Resource "already maximized" or, alternatively, when it completes maximization activities and to make it clear the Resource must comply with the ride-through requirements in effect on 5/1/24 until maximized to meet the new requirements
* Category 1: Sections 2.11.1(1); 2.11.2(1)
  + Clarifies the information the Resource Entity must include in the IFRTCR and removes some requirements Joint Commenters found objectionable
  + Provides a mechanism for Resource Entities to provide an explanation of why it could not get an OEM representative or consultant to describe the reason the equipment cannot meet ride-through requirements
  + Makes it clear Resource Entity cannot obtain an exemption or extension if it does not timely file an IFRTCR/IVRTCR but may provide additional information if ERCOT requests
* Categories 2 and 3: Section 2.12.1(1) Corrects section references and confirms existing facilities that do not meet the ride-through requirements must request an extension or exemption by 4/1/25 and the criteria for granting an exemption will be determined in a subsequent NOGRR
* Category 2: Section 2.12.1(2) Makes clear any exemption requests may only be supplemented with additional information under processes established in a subsequent NOGRR and ERCOT will accept no *new* exemption requests after 4/1/25
* Category 4: Sections 2.12.1(3) and (4) Deleted because requirements are captured in revised language for IFRTCRs/IVRTCRs and to address language the Joint Commenters found objectionable
* Category 1: Renumbered Section 2.12.1(6) Clarifies when exemptions terminate
* Category 1: Renumbered Section 2.12.1(7) Changes it from a sub-section of 2.12.1(6) to a stand-alone sub-section of 2.12.1 and includes language requested by Joint Commenters to make it clear the requirement applies only to *newly available software, firmware, settings and parameterization modifications*
* Category 3: Renumbered Sections 2.12.1(8) and (9) Correct section reference due to modifications
* Category 1: Renumbered Section 2.12.1(10) Makes it clear that, until of an exemption, extension or appeal is finalized, Resource must meet the greater of its maximized ride-through capability or the ride-through requirements in effect on 5/1/24
* Category 1: Renumbered Section 2.12.1(11) Makes it clear ERCOT will not report a Resource to the ERCOT Reliability Monitor based on information in an IFRTCR or IVRTCR so long as the Resource meets the requirements in (10), above
* Category 1: Renumbered Section 2.12.1(12) Makes it clear all information submitted per Sections 2.11 and 2.12 are considered Protected Information
* Category 1: Section 2.12.1.1(2) Makes it clear a Resource Entity requesting an exemption must timely submit an IFRTCR or IVRTCR and removes enumerated data for the Resource Entity to provide because the data requirement was moved to the IFRTCR and IVRTCR sections
* Category 1: Section 2.12.1.2(1) Makes it clear Resource Entities must submit extension requests by 4/1/25
* Category 4: Section 2.12.1.2(5) Removed because the data submission requirements were moved to the IFRTCR and IVRTCR sections
* Category 4: Renumbered Section 2.12.1.2(5) Revised because Table C was deleted
* Category 2: Section 2.12.1.3 Removes “exemption” from the title because it now applies to only extension requests
* Category 1: Section 2.12.1.3(2) Cleans up language
* Category 2: Sections 2.12.1.3(3), (4) and (5) Remove references to exemptions (because they will be addressed by a subsequent NOGRR)
* Category 3: The title for Section 2.12.1.4 Removed and sub-sections renumbered to become part of Section 2.12.1.3
* Category 2: Renumbered Section 2.12.1.4(6) and (7) Remove references to exemptions (because they will be addressed by a subsequent NOGRR)

**Revised Cover Page Language**

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| **Nodal Operating Guide Sections Requiring Revision** | 2.6.2, Generators and Energy Storage Resources  2.6.2.1, Frequency Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs)  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 and Extensions 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 Extension Requests (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 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 in an attempt to meet or exceed the new voltage ride-through requirements and the new frequency ride-through requirements as soon as practicable with all available software, firmware, settings and parameterization changes. IBRs and Type 1 and Type 2 WGRs that cannot meet the ride-through requirements will need to submit a request for exemption or extension 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. During the implementation window or an approved extension, existing IBRs and Type 1/Type 2 WGRs will have to ensure they at least comply with the ride-through requirements in the Operating Guides in effect as of May 1, 2024 until they maximize their 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 upon replacement/retrofit meet the latest IEEE 2800 standard and preferred voltage ride-through requirements and will no longer be granted such 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 immediately 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. Except when caused by reductions associated with intermittent primary energy source availability (e.g., wind speed or solar irradiance), an IBR, Type 1 WGR or Type 2 WGR shall not reduce active current injection during frequency conditions requiring ride-through unless allowed pursuant to paragraph (4) of Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) or paragraph (4) 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 to provide appropriate frequency response.

(5) IBR, Type 1 WGR and Type 2 WGR plant controls, turbine controls and/or inverter controls shall not disconnect the plant or any individual inverter/turbine, or prevent current exchange between the Resource and the ERCOT Transmission Grid during frequency conditions where ride-through is required.

(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.  The Resource Entity must inform ERCOT (in a manner prescribed by ERCOT) of the date on which the IBR, Type 1 WGR or Type 2 WGR has fully maximized its ride-through capability to equipment limits. To establish ride-through capabilities to the maximum extent the equipment allows as used throughout Section 2.6.2, Frequency Ride-Through Requirements for Generation Resources and Energy Storage Resources, means making software, settings, firmware, and parameterization changes, which includes any memory upgrades to accommodate such changes, to maximize the frequency ride-through capabilities of the Resource in accordance with Good Utility Practice.



(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, submit an Initial Frequency Ride-Through Capability Report (“IFRTCR”) pursuant to Section 2.11.1, Initial Frequency Ride-Through Capability Documentation and Reporting Requirements, and request an exemption or extension pursuant to Section 2.12.1, Exemptions and Extensions Process. The Resource must comply with the frequency ride-through requirements in effect on May 1, 2024 until the Resource maximizes its frequency ride-through capability as set forth in paragraph (6) above.

(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), Type 2 WGRs and Type 3 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), Type 2 WGRs and Type 3 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; and

(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, as appropriate, 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 prior to January 1, 2028, 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 August 1, 2024 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. The Resource Entity must inform ERCOT (in a manner prescribed by ERCOT) of the date on which the IBR, Type 1 WGR, Type 2 WGR or Type 3 WGR has fully maximized its capability with respect to the specified IEEE 2800-2022 requirements. To establish capabilities to the maximum extent the equipment allows as used throughout this Section means the Resource Entity must make software, settings, firmware, and parameterization changes, which includes any memory upgrades to accommodate such changes, to maximize capabilities of the Resource with respect to the specified IEEE 2800-2022 requirements in accordance with Good Utility Practice.

(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, 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 | (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 | (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.



(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. Except when caused by reductions associated with intermittent primary energy source availability (e.g., wind speed or solar irradiance), an IBR shall not reduce active current injection during voltage conditions requiring ride-through unless allowed in this paragraph or to provide appropriate frequency response. 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 plant, or any individual inverter/turbine, or prevent current exchange between the IBR and the ERCOT Transmission Grid during voltage conditions where ride-through is required.

(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 Alternating Current instantaneous over-voltage protection that could disrupt IBR power output shall use a measurement window of at least one cycle of fundamental frequency.

(7) An IBR shall not use phase angle jump or rate-of-change-of-frequency measurement quantities as a basis for reducing power output or tripping offline during fault conditions and subsequent recovery to a steady-state operating point within the ride-through profiles specified in paragraph (1) above.

(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 requirements of paragraphs (1) through (7) above by December 31, 2025. 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 and Extensions for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2WGRs. Any temporary extensions under this paragraph shall be minimized and not extend beyond December 31, 2028.

(9) A Resource Entity of a Type 3 WGR may seek an extension for completing modifications to meet the voltage ride-through performance Table A 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.

(10) 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.

(11) 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), Type 2 WGRs, and Type 3 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. Except when caused by reductions associated with intermittent primary energy source availability (e.g., wind speed or solar irradiance), an IBR, Type 1 WGR or Type 2 WGR shall not reduce active current injection during voltage conditions requiring ride-through unless allowed in this paragraph or to provide appropriate frequency response. 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 plant or any individual inverter/turbine, or prevent current exchange between the Resource and the ERCOT Transmission Grid during voltage conditions where ride-through is required.

(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 Alternating Current instantaneous over-voltage protection that could disrupt power output shall use a measurement period of at least one cycle (of fundamental frequency).

(7) An IBR, Type 1 WGR or Type 2 WGR shall not use phase angle jump or rate-of-change-of-frequency measurement quantities as a basis for reducing power output or tripping offline during fault conditions and subsequent recovery to a steady-state operating point within the ride-through profiles specified in paragraph (1) above.

(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 (7) above by December 31, 2025 after maximizing the performance of its protection systems, controls, and other plant equipment (within equipment limitations), the Resource Entity shall, by April 1, 2025, submit an Initial Voltage Ride-Through Capability Report (“IVRTCR”) pursuant to Section 2.11.2, Initial Voltage Ride-Through Capability Documentation and Reporting Requirements, and request an extension to comply pursuant to Section 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions and Extensions for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs. If the Resource Entity submits an IVRTCR and cannot comply with paragraphs (1) through (7) above with an extension, it must request an exemption pursuant to Section 2.12. The Resource Entity must comply with the voltage ride-through requirements in effect on May 1, 2024 until it maximizes its voltage ride-through capability.

(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**

(1) If the Resource Entity for an Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR) or Type 2 WGR believes one or more of its Resources (i) has already maximized its ride-through capabilities to meet or exceed the applicable ride-through performance requirements, or (ii) will maximize its ride-through capabilities with available software, firmware, settings and parameterization changes to meet or exceed the applicable ride-through performance requirements before December 31, 2025, the Resource Entity must submit to ERCOT accurate models reflecting the field settings of the IBR, Type 1 WGR or Type 2 WGR consistent with applicable requirements for model updates in these Protocols and Other Binding Documents.

(2) Until an IBR, Type 1 WGR or Type 2 WGR completes the work to maximize ride-through capability as required in 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; 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs), Type 2 WGRs and Type 3 WGRs; 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 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs, the Resource must comply with the ride-through requirements in effect on May 1, 2024.

(3) Upon completing the work to maximize ride-through capability as required in Sections 2.6.2.1; 2.9.1; 2.9.1.1; and 2.9.1.2, the Resource Entity shall inform ERCOT (in a manner prescribed by ERCOT) it has completed the work to maximize ride-through capability for each Resource.

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

(1) The Resource Entity of an IBR, Type 1 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 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 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, an Initial Frequency Ride-Through Capability Report (“IFRTCR”) containing the following:

(a) The Resource Entity DUNS Number;

(b) IBR/WGR Site Name;

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

(d) Nodal Operating Guide Section(s) with which the Resource cannot comply;

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

(f) 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;

(g) 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 limitations:

1. If a Resource Entity cannot address the entire plant design with a letter required in paragraph (1)(g) above, the Resource Entity must supplement a letter from the original equipment manufacturer for its equipment (or subsequent support company if the original equipment manufacturer is no longer in business) or an engineering consulting firm by providing a notarized attestation sworn to by the Resource Entity’s highest-ranking representative, official, or officer with binding authority over the entity attesting to: the efforts made to obtain the letter, why those efforts failed, and which parts of the plant design is attested to. The attestation shall also include a detailed description of the technical limitation(s) preventing the Resource from meeting the ride-through requirement, including any information on technical limitations on all or part of the Resource which the Resource Entity is able to obtain from original equipment manufacturers or an engineering consulting firm under paragraph (1)(g) above;

(h) Available software, firmware, settings or parameterization 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;

(i) To the extent the Resource Entity chooses to implement changes to existing equipment other than software, firmware, settings or parameterization modifications that increase the frequency ride-through capability, identification of any such equipment modifications;

(j) 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;

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

(l) A model accurately representing expected performance reflecting all technical limitations, or a statement that there are no new models available other than what is currently submitted to ERCOT that already reflect all technical limitations in frequency ride-through capability; and

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

(2) If a Resource Entity does not timely provide to ERCOT an IFRTCR by April 1, 2025, the Resource will not be eligible for an exemption or extension to comply with the ride-through requirements. If a Resource Entity timely provides an IFRTCR by April 1, 2025 and ERCOT requests additional information, it will not render the Resource ineligible for an exemption.

***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 (7) 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, an Initial Voltage Ride-Through Capability Report (“IVRTCR”) containing the following:

(a) The Resource Entity DUNS Number;

(b) IBR/WGR Site Name;

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

(d) Nodal Operating Guide Section(s) with which the Resource cannot comply;

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

(f) Known voltage ride-through limitations of the IBR, Type 1 WGR or Type 2 WGR as compared to the requirements in paragraphs (1) through (7) of Section 2.9.1.2;

(g) 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 limitations:

(i) If a Resource Entity cannot address the entire plant design with a letter required in paragraph (1)(g) above, the Resource Entity must supplement a letter from the original equipment manufacturer for its equipment (or subsequent support company if the original equipment manufacturer is no longer in business) and an engineering consulting firm by providing a notarized attestation sworn to by the Resource Entity’s highest-ranking representative, official, or officer with binding authority over the entity attesting to: the efforts made to obtain the letter, why those efforts failed, and which parts of the plant design is attested to. The attestation shall also include a detailed description of the technical limitation(s) preventing the Resource from meeting the ride-through requirement, including any information on technical limitations on all or part of the Resource which the Resource Entity is able to obtain from original equipment manufacturers or an engineering consulting firm under paragraph (1)(g) above;

(h) Available software, firmware, settings, or parameterization 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 (7) of Section 2.9.1.2 within known equipment limitations, to the greatest extent possible;

(i) To the extent the Resource Entity chooses to implement changes to existing equipment other than software, firmware, settings or parameterization modifications that increase the voltage ride-through capability, identification of any such equipment modifications;

(j) 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;

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

(l) A model accurately representing expected performance reflecting all technical limitations, or a statement that there are no new models available other than what is currently submitted to ERCOT that already reflect all technical limitations in voltage ride-through capability; and

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

(2) If a Resource Entity does not timely provide to ERCOT an IVRTCR by April 1, 2025, the Resource will not be eligible for an exemption or extension to comply with the ride-through requirements. If a Resource Entity timely provides an IVRTCR by April 1, 2025 and ERCOT requests additional information, it will not render the Resource ineligible for an exemption.

**2.12** **Procedures for Frequency and Voltage Ride-Through Exemptions and Extensions 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 (7) 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 paragraph (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), Type 2 WGRs and Type 3 WGRs, or certain voltage ride-through requirements in accordance with paragraph (9) 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”) must request from ERCOT, by April 1, 2025: (i) an extension to meet such requirements or (ii) an exemption based on standards established in a subsequent Nodal Operating Guide Revision Request (NOGRR).

(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 as part of the Initial Frequency Ride-Through Capability Report (“IFRTCR”) and Initial Voltage Ride-Through Capability Report (“IVRTCR”) as applicable. No new exemption requests beyond April 1, 2025, detailing additional technical limitations of ride-through requirements are allowed. An exemption request may be supplemented only with additional information, including updated models reflecting improved ride-through capability, under processes established in a subsequent NOGRR.



(3) 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.

(4) 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.

(5) Exemptions and extensions take effect immediately upon approval by ERCOT and apply only to the extent approved by ERCOT.

(6) Exemptions continue until:

(a) 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; or

(b) The IBR, Type 1 WGR or Type 2 WGR fully implements a modification that eliminates the need for the exemption.

(7) If ERCOT or the Resource Entity becomes aware of a newly available software, firmware, settings or parameterization modification for a Resource with an exemption, 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.

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

(9) The deadlines in Section 2.12.1.2 may be modified by mutual written agreement of ERCOT and the Requesting Entity.

(10) Until the consideration of an exemption, extension, or appeal process is finalized, the IBR, Type 1 WGR or Type 2 WGR with an SGIA prior to August 1, 2024 that has submitted an exemption or extension request and any required documentation by April 1, 2025 must meet the greater of: (i) its documented maximum ride-through 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.

(11) ERCOT shall not use a Resource Entity’s IFRTCR or IVRTCR as a basis for referral to the Reliability Monitor so longs as the Resource meets the applicable ride-through requirements set forth in paragraph (10) above.

(12) All information submitted under Sections 2.11, Ride-Through Reporting Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs and 2.12, Procedures for Frequency and Voltage Ride-Through Exemptions and Extensions for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs) and Type 2 WGRs 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), Type 2 WGRs and Type 3 WGRs may seek an exemption as described in that Section.

(2) The Resource Entity requesting an exemption for an IBR, Type 1 WGR, Type 2 WGR must, by April 1, 2025, submit an IFRTCR or IVRTCR describing the need for the exemption consistent with Sections 2.11.1, Initial Frequency Ride-Through Capability Documentation and Reporting Requirements or 2.11.2, Initial Voltage Ride-Through Capability Documentation and Reporting Requirements.

***2.12.1.2 Submission of Extension Requests***

(1) Unless otherwise approved by ERCOT, extension requests must be submitted by April 1, 2025. 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), Type 2 WGRs and Type 3 WGRs or 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.

(4) 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.

(5) If a Requesting Entity submits a request for an extension to meeting the performance requirements in Table A 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.

(6) 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 Extension Requests***

(1) As soon as practicable after receiving a request for an 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 or request additional time to provide the additional information with an explanation for the delay.

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

(4) During the time ERCOT considers an 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 or extension request process within 180 days after receiving a complete request for an 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 extension is:

(a) Approved;

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

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

(6) Upon issuance of ERCOT’s decision on an 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.

(7) 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 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, Temporary 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), Type 2 WGRs and Type 3 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.