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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** | March 20, 2024 |

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| **Market Segment** | Not applicable |

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| **Comments** |

ERCOT submits these comments on top of its January 8, 2024 comments. ERCOT has made the following changes.

1. **ERCOT removed all references to Subsynchronous Resonance (SSR) Mitigation** to defer any desired clarifications until a future Nodal Protocol Revision Request (NPRR) and Nodal Operating Guide Revision Request (NOGRR) focusing on that topic. Until such language can be added, ERCOT recognizes circumstances may exist where slower control response times (slower than the required *capability*) may be appropriate and acceptable, such as part of SSR mitigation plans. However, those circumstances should be mutually agreeable between ERCOT, the TSP and the Resource Entity. Furthermore, if the system needs SSR mitigation ***and*** faster controls response, ERCOT continues to assert the Resource Entity is responsible for meeting the required control response times ***and*** SSR mitigation. A Resource Entity introduces SSR challenges by choosing to interconnect particularly vulnerable technologies near series-compensated lines. This approach will help encourage entities to consider location, technology, and equipment capabilities when choosing projects.

1. **ERCOT removed all explicit references to “operational restrictions” and implied exceptions related to preventing equipment damage.** ERCOT originally included language regarding imposing operational restrictions on a Resource that cannot meet ride-through performance requirements to make transparent ERCOT’s intent to use such restrictions to mitigate critical reliability risk and incentivize urgency for Resources that must implement modifications following ride-through failures. The Joint Commenters asked ERCOT to remove that language and, therefore, in this version of NOGRR245, ERCOT did so. This revision does not, however, imply ERCOT does not have the authority to take such actions to protect the reliability of the ERCOT System. The following reliability requirements dictate that ERCOT must take actions necessary to protect the ERCOT System:

* NERC Reliability Standard TOP-001, R1 requires ERCOT, as a Transmission Operator, to maintain the reliability of its area via its own actions or issuing Operating Instructions.
* NERC Reliability Standard IRO-001, R1 requires ERCOT, as a Reliability Coordinator, to address the reliability of its area via direct actions or issuing Operating Instructions.
* PUCT Rule 25.361(b) requires ERCOT to perform the functions of an independent organization to *ensure the reliability* of the regional electrical network.
* PUCT Rule 25.361(b)(4) provides that ERCOT shall *maintain the reliability and security of the ERCOT region's electrical network*.
* Protocols 6.5.1.1(1) provides, among other things, that ERCOT is authorized to perform the following actions *for securely operating the ERCOT Transmission Grid* under the NERC standards, the Operating Guides and Protocols, including: (a) directing the physical operation of the ERCOT Transmission Grid, including circuit breakers, switches, voltage control equipment, and Load-shedding equipment.

Next, Joint Commenters sought to include language in various locations of the NOGRR excepting them from ride-through requirements if a performance failure resulted from preventing damage to equipment. ERCOT removed those references because, while every owner has a responsibility to protect its equipment, failing to comply with ride-through requirements for any reason still means the Resource did not comply with the ride-through requirement and must mitigate future performance failures.

ERCOT inserted Section 2.9.1(5) to make it clear ERCOT  may disconnect an IBR or Type 1 WGR or Type 2 WGR that is unable to ride-through disturbances where the POIB voltage remains within its applicable performance requirements if needed to address a reliability issue in real time to align with similar language in the Protocols (e.g., Section 3.15(4)(e), which allows similar actions when an IRR operates below 10% of its capacity).

1. **ERCOT extended the Commercial Operations Date for exemptions to IEEE requirements for *new* IBRs from June 1, 2026 to December 31, 2026.** Some original equipment manufacturers (OEMs) have already adapted (or are quickly adapting) technology to meet IEEE 2800-2022 requirements and await clarity on testing requirements to ensure appropriate preparedness. Like other efforts nationwide, ERCOT proposes the higher ride-through requirements in IEEE 2800-2022 to apply to new IBRs. ERCOT has focused adoption of the most critical sections of IEEE 2800-2022 and will address other sections in future revision requests. While ERCOT has repeatedly signaled this adoption to Market Participants since early 2022, ERCOT originally proposed to have the IEEE 2800-2022 requirements apply to all new facilities with standard generation interconnection agreements (SGIAs) dated after January 1, 2023. However, some OEMs needed additional time to adapt their designs and equipment to meet the new requirements. ERCOT, therefore, agreed to move the referenced SGIA date from January 1, 2023 to June 1, 2023 expecting that, after having discussed this at numerous stakeholder meetings and technical forums for well over 18 months, developers and OEMs were prepared and aligned their practices to procure equipment capable of meeting the new requirements for future installations. ERCOT recognized, at that time, this 6 month deferral would effectively allow ~6 GWs of additional IBR capacity to avoid the obligation to meet the IEEE 2800-2022 requirements. Joint Commenters seek to move the applicable date for the new requirements to some time *even further* in the future. ERCOT does not support extending the date further because doing so would likely cause an influx of new SGIAs to avoid the new requirements, which undermines reliability. Further, as of the end of February 2024, moving the date would allow an additional 20-30 GWs of IBR projects to avoid the new requirements (although, under ERCOT’s proposal, they must still meet the *current* ride-through requirements). ERCOT has proposed language in Section 2.9.1(1)(b)(iii) allowing exemptions for IBRs with a Commercial Operations Date prior to certain threshold that cannot fully meet certain requirements and allows new IBRs that meet *most* of the requirements to have additional time to meet *all* requirements. ERCOT initially moved the associated Commercial Operations Date threshold from January 1, 2026 to June 1, 2026 and now proposes moving the date to December 31, 2026 to allow more time for exemptions. Finally, ERCOT allows an extension in Section 2.9.1(1)(b)(ii) up to December 31, 2028 to accommodate OEMs who have signaled to ERCOT the capability to design or implement upgrades for some new - but slightly older - models requiring upgrades to comply with the new requirements but that could not be interconnected by December 31, 2026. These provisions assume entities will maximize ride-through capability and the limitation-based exemptions will be minor in nature and still exceed *current* ride-through requirements - thus benefiting reliability. ERCOT does not support extending this date further. Despite Joint Commenters’ assertion, this proposal does not constitute “retroactive” application of IEEE 2800-2022 as it applies only to units with SGIAs after 6/1/23 and provides for exemptions and extensions for a reasonable period of time.

1. **ERCOT incorporated the “Commercially Reasonable Efforts” section.** In the spirit of compromise, ERCOT incorporated Commercially Reasonable Efforts language even though ERCOT believes that doing so negatively impacts grid reliability. While ERCOT continues to insist reliability is the highest priority, it incorporated this language: (i) because Joint Commenters adamantly insisted on it and (ii) to incentivize Resource Entities to quickly implement easier, less costly changes. ERCOT wants to make clear to TAC that incorporating the “commercially reasonable” concept will, ultimately, harm reliability. Additionally: (i) allowing unreliable IBRs and WGRs to remain on the ERCOT System without implementing *available* upgrades to improve ride-through capability leaves an unacceptable reliability risk due to ride-through performance failures and removing reliabilityrisk should outweigh commercial considerations; (ii) lack of firm requirements does not incentivize OEMs to produce solutions to improve ride-through performance; and (iii) “innocent bystander” stakeholders will bear the burden of paying for transmission upgrades, congestion charges, potential blackouts and equipment impacts to accommodate the commercial profits of IBR and WGR owners who have sought to avoid ride-through requirements since their facilities were first installed (and continue to seek favorable treatment). ERCOT believes the best, most cost-efficient method to address the reliability risk caused by IBR and WGR inability to ride-through normal system disturbances is to require them to perform the same as other Resources during disturbances. Remaining reliability risk from Resource Entities' decisions to avoid implementing *technically feasible* solutions to improve grid reliability simply because they do not consider them *commercially* reasonable (in their determination) will ultimately be addressed by less cost-efficient mechanisms.

ERCOT views the adoption of the Joint Commenters’ concept of commercial reasonability as a significant concession that detrimentally impacts grid reliability. However, the Joint Commenters agreed to deem software, firmware, settings or parameterization changes “commercially reasonable” as a compromise.

As noted in previous stakeholder meetings, an IBR’s failure to properly ride-through a disturbance and return to service after a few seconds to several minutes is not a significant issue for the individual IBR owner but *is* a significant issue for overall grid reliability. The absence of a firm requirement to implement technically feasible solutions to improve grid reliability will stifle OEMs’ incentive to develop reliability-related solutions because IBR owners (particularly for legacy plants qualifying for an exemption) may not pursue such solutions and, therefore, OEMs have no financial incentive to develop them. Throughout the discussions and RFIs regarding NOGRR 245, OEMs repeatedly signaled the ability to offer technically feasible improvements to generators to improve ERCOT System reliability and avoid major events; however, most of the improvements may not be developed or implemented because IBR owners will deem them “not commercially reasonable.”

1. **ERCOT aligned report submittal dates.** At Joint Commenters’ request, ERCOT aligned the date for providing reports regarding “commercially reasonable efforts” with the initial report due date for REs that cannot meet the December 31, 2025 compliance deadline. The initial report date has been moved from December 31, 2024 to February 1, 2025 to allow REs to focus on implementing commercially reasonable upgrades and reporting when those upgrades cannot be timely implemented as a priority. Then, beginning February 1, 2026, the first annual reports related to commercially reasonable efforts for IBRs with documented technical exemptions become due as identified in Section 2.11(4).

1. **ERCOT clarified when the addition of a co-located Load would trigger higher voltage ride-through requirements**. Due to continued requests for additional specificity by Joint Commenters and other stakeholders, ERCOT modified the language in section 2.9.1(1)(a)(iv) to provide that the addition of co-located Load would not trigger higher voltage ride-through requirements except under limited circumstances, which should help clarify that normal equipment modifications at a plant to naturally interconnect the new Load should not trigger the higher requirements. Modifications to shunt reactive devices would also typically not trigger new requirements - so long as they do not materially modify the plant’s frequency or voltage ride-through capability (shunt reactive devices are static reactive devices for voltage drop or rise compensation typically not part of any switching that should affect ride-through capability).

1. **ERCOT removed language requiring that exemptions could not create any risk of instability, uncontrolled separation or cascading outages for the ERCOT System**. ERCOT intended this language to capture similar language to the definition of “reliable operations” in Section 215 of the Federal Power Act. Joint Commenters asked to remove the language due to application uncertainty. ERCOT believed such situations would be rare but prudent to not allow an exemption that, when coupled with an updated model, clearly demonstrated unreliable operations. In the spirit of compromise, ERCOT removed the language with the understanding that, in the event of such an occurrence, ERCOT would employ all measures to prevent unreliable operations including, but not limited to, creating a new stability limit or Interconnection Reliability Operating Limit (IROL). Additionally, if needed, ERCOT would take all actions up to and including firm load shed or disconnecting the generator to remove unacceptable risk as stated above.

1. **ERCOT proposes to defer specific requirements defining phase angle jump, rate-of-change-of-frequency (RoCoF) and multiple excursion thresholds for legacy units for a future revision request.**  On-going technical discussions have highlighted the need for additional discussions and clarity to identify how these quantities measured and utilized in protection settings during both fault and non-fault conditions. As shown in the RFI results, many OEMs have not tested or verified their units’ capabilities. Mishandling these requirements could worsen ride-through performance, further adversely impacting reliability. While Joint Commenters desire broad exemptions for unknown capabilities, ERCOT strongly opposes such an approach. Many parameters may actually link to other equipment that could be tuned or modified (such as the phase lock loop circuits) using filtered measurements or k factor settings.  Put simply, these issues require additional vetting.  In the interim, ERCOT would maintain the current requirement that all Generation Resources not trip or unnecessarily reduce output during fault events. Industry SMEs agree RoCoF and phase angle jump cannot be accurately measured during fault events and, therefore, any perceived values of these quantities should not prevent ride-through during fault events when voltage and frequency are within the ride-through region. This approach aligns with previous NERC recommendations and the latest draft language from the IEEE P2800.2 working group and maintains the status quo on expectations and requirements. While joint commenters assert that ERCOT allows certain exemptions with new IBRs because IEEE 2800-2022 allows an IBR to trip when the phase angle for non-fault conditions exceeds 25 electrical degrees or RoCoF for non-fault conditions exceeds 5 Hz/second (or higher as determined by ERCOT/TSP), the ERCOT proposed language intentionally remains silent other than noting that “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 {applicable facilities} during fault conditions”, in Sections 2.9.1.1(8) and 2.9.1.2(7). While ERCOT would not generally consider IBR tripping for similar non-fault conditions to be a performance failure, additional work is needed to understand how units measure and use these parameters so ERCOT stakeholders can establish the proper requirements (IEEE 2800-2022 allows for >5 Hz/sec requirement, which is critical with fast increasing voltage-sensitive large loads). Additionally, Vestas has raised an issue with multiple excursion requirements related to energy dissipation that needs additional discussion as well as Transmission Service Providers (TSPs) having discussions around reclose schemes used around generators. For these reasons, ERCOT strongly recommends a future NOGRR address RoCoF, phase angle jump and multiple excursion issues (for legacy IBRs).
2. **ERCOT modified language giving it “sole and reasonable discretion” to grant exemptions and extensions to provide that ERCOT will grant exemptions/extensions when the Resource Entity provides evidence acceptable to ERCOT.** ERCOT modified language in multiple paragraphs providing for limited technical exemptions and temporary extensions to remove references to ERCOT’s “sole and reasonable” discretion in granting an exemption/extension at Joint Commenters’ request. While ERCOT must always ensure reliable operations, ERCOT modified the language to ensure it will grant an exemption/extension when the Resource Entity provides acceptable evidence.
3. **ERCOT added language describing the processes for exemptions, extensions and appeals.** Specifically, ERCOT added Section 2.12 to address the processes for Market Participants to obtain exemptions, extensions and to appeal ERCOT decisions regarding those matters. ERCOT also drafted a definition of “ride-through” to clarify the requirements.
4. **ERCOT modified Tables A and B in 2.9.1.1(1) to ensure voltage ride-though requirements for new units will not be reduced.**  ERCOT does not believe reliability would be improved if new units can trip for conditions legacy units had to ride through.  Therefore, ERCOT added the section of the legacy LVRT ramp curve below 0.25 p.u. voltage to the preferred LVRT curves.  This change should not have a significant impact on facilities or compliance because IBRs connecting in the ERCOT Region have been required to have the capability being added to the curve since 2008.  This change also facilitates model testing and review because all units can be tested and evaluated with the same ramp curve.  ERCOT added a clarification to note that the minimum ride-through time includes any amount of time the POIB voltage is below the specified voltage region to prevent a potential misinterpretation.  For example, if voltage at a WGR POIB was less than 0.25 p.u. for 0.1 seconds and then recovered to 0.3 p.u., the WGR would have to ride-through that 0.3 p.u. voltage for at least 1.1 seconds (not 1.2 seconds) because minimum ride-through time of 1.2 seconds for voltage between 0.25 p.u. and 0.5 p.u. would include the 0.1 second voltage was below 0.25 p.u.
5. **ERCOT made several other minor updates throughout the NOGRR to merge requirement language concerns from Joint Commenters into the ERCOT version.** ERCOT and Joint Commenters requested several language changes to implement compromises to clarify, limit, make consistent, or otherwise address concerns with various concepts. Because these comments started with the ERCOT comments submitted on 1/8/24, multiple language changes bring the new language closer to the Joint Commenters’ language or otherwise address concerns Joint Commenters addressed differently in their proposed language revisions.

In addition to the above changes, ERCOT has the following comments to respond to stakeholder raised issues.

***Current Ride-through Requirements***

The Joint Commenters take the position the existing Operating Guides § 2.9 language creates only a “design standard” for relay settings and does not require IBRs to ride-through system disturbances. ERCOT, on the other hand, believes existing Operating Guides language clearly creates performance obligations.

Specifically, Operating Guides § 2.9 is titled, “***Voltage Ride-Through Requirements*** for *Generation Resources.*” (emphasis added) Intermittent Renewable Resources (IRRs) are “Generation Resources” and, therefore, § 2.9 applies to them.1

Next, Operating Guides § 2.9(2) provides:

During operating conditions listed in paragraph (1) above, each *Generation Resource* *shall not*…*cease providing real or reactive power* except to the extent needed to provide frequency support or aid in voltage recovery. (emphasis added)

Thus, Operating Guides § 2.9(2) *is* a performance requirement and applies to wind and solar Resources.

Operating Guides § 2.9.1(4) provides:

Each IRR *shall remain interconnected during three-phase faults* on the ERCOT System for a voltage level as low as zero volts with a duration of 0.15 seconds as measured at the Point of Interconnection Bus (POIB) unless a shorter clearing time requirement for a three-phase fault specific to the generating plant POIB is determined by and documented by the TSP in conjunction with the SGIA. The clearing time requirement shall not exceed nine cycles. (emphasis added)

Figure 1 in Operating Guides § 2.9.1 is called “Default ***Voltage Ride-Through Boundaries*** for IRRs Connected to the ERCOT Transmission Grid” (emphasis added) and clearly shows a “***No Tripping***” zone, making it clear IRRs *may not trip* for voltages and times indicated in Figure 1.

Operating Guides § 2.9.1(7) provides:

*Voltage ride-through requirements* *may be met* by the performance of the generators; by installing additional reactive equipment behind the Point of Interconnection (POI); or by a combination of generator performance and additional equipment behind the POI. [V]oltage ride-through requirements may be met by equipment outside the POI if documented in the SGIA.

Thus, the language in Operating Guides § 2.9.1(7) makes it clear IRRs must *meet* the voltage ride-through requirements.

Lastly, Operating Guides § 2.9.1(8) provides, “[i]f an IRR fails to comply with the clearing time or recovery voltage ride-through requirement, then the IRR and the interconnecting TSP shall be required to investigate and report to ERCOT on the cause of the IRR trip, identifying a reasonable mitigation plan and timeline.”

Taken together, the above-referenced requirements make it clear the existing language in Operating Guides § 2.9 requires IRRs to ride-through system disturbances and is *not* simply a “design standard.” Ultimately, however, the Public Utility Commission has authority to enforce the Operating Guides language and will determine its applicability, if necessary.

***Exemptions for Legacy IBRs and WGRs***

Potential exemptions to proposed section 2.9.1.2 (1) through (7) due to commercial reasonability are available for existing IBRs or Type 1 WGRs or Type 2 WGRs with an SGIA executed on or before June 1, 2023.

The voltage ride-through profile in the proposed section 2.9.1.2, Table A is identical to the Figure 1 voltage ride-through boundaries in the existing Section 2.9.1, which apply fully to all IRRs with an SGIA after 1/16/14. Therefore, ERCOT contends that any IBR or Type 1 WGR or Type 2 WGR with an SGIA after 1/16/14 that cannot comply with the requirements in Section 2.9.1.2 (1) through (7) are not in compliance with the *current* Operating Guides that require IRRs to ride through system disturbances.  However, to reasonably respond to Joint Commenters’ potential misinterpretation of existing requirements, ERCOT has proposed potential limited technical exemptions for IBRs or Type 1 WGRs or Type 2 WGRs with an SGIA after January 16, 2014 that can demonstrate a documented technical limitation to fully meeting the requirements in Section 2.9.1.2 (1) through (7).  ERCOT proposes to limit exemptions to avoid unacceptable reliability risk.  ERCOT believes this is a reasonable compromise and creates a “guard rail” preventing exemptions that undermine reliability.  ERCOT proposes no exemptions use phase angle or RoCoF measurements during fault conditions to trip or reduce output. As discussed above, more technical discussion must occur to address these parameters in a future NOGRR.

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| **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 Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs) (new)  2.6.2.1, Frequency Ride-Through Requirements for Distribution Generation Resources (DGRs) and Distribution Energy Storage Resources (DESRs)  2.6.2.1.1, Temporary Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs) (new)  2.9, Voltage Ride-Through Requirements for Generation Resources  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) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs) (new)  2.11, Commercially Reasonable Efforts (new)  2.12, Exemptions, Extensions and Appeal Process (new)  2.12.1, Exemptions and Extensions (new)  2.12.2, Commercially Reasonable Determination (new) |
| Revision Description | This Nodal Operating Guide Revision Request (NOGRR) replaces the current voltage ride-through requirements for Intermittent Renewable Resources (IRRs) with voltage ride-through requirements for Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-powered Generation Resources (WGRs)and provides new frequency ride-through requirements for IBRs and Type 1 and 2 WGRs consistent with or beyond requirements identified in the new 2800-2022 - Institute of Electrical and Electronics Engineers (IEEE) Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems (“IEEE 2800-2022 standard”). |
| Justification of Reason for Revision and Market Impacts | ERCOT submits this NOGRR based on reliability issues associated with the inability of some IBRs, Type 1 WGRs and Type 2 WGRs 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 with an SGIA after June 1, 2023 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. ERCOT proposes a limited, defined window of time for new IBRs to request limited technical exemptions or extensions as developers and original equipment manufacturers transition to the IEEE2800-2022 standard if they are not already doing so. Additionally, due to some Type 1 and 2 WGRs failing to ride through normal system disturbances, ERCOT proposes to maintain requirements as they currently exist for an IRR. 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 making adjustments after a failure occurs. ERCOT proposes to maintain existing voltage ride-through requirements for legacy IBRs, Type 1 WGRs and Type 2 WGRs but require Resource Entities to coordinate protection and controls for the entire plant to ensure meeting the performance requirements.  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, ERCOT does not propose to grandfather existing IBRs and Type 1 and Type 2 WGRs indefinitely. Rather, ERCOT proposes all IBRs and Type 1 and Type 2 WGRs with a Standard Generation Interconnection Agreement (SGIA) executed prior to June 1, 2023 (“existing IBRs”), maximize ride-through capability to meet or exceed the existing voltage ride-through ranges and the new frequency ride-through ranges as soon as practicable but no later than December 31, 2025. IBRs and Type 1 and Type 2 WGRs that cannot meet the new ride-through requirements must submit a report by February 1, 2024 documenting that fact and providing a mitigation plan to give ERCOT an accurate understanding of the physical limitations and maximum ride-through capability. IBRs, Type 1 WGRs and Type 2 WGRs needing additional time to fully meet the requirements may receive an extension up to December 31, 2027. IBRs, Type 1 WGRs and Type 2 WGRs that demonstrate a limitation to meeting the requirements may receive a limited technical exemption upon ERCOT approval. An IBR or Type 1 WGR or Type 2 WGR that will be replaced or retrofitted and has documented technical exemptions must meet the latest IEEE 2800-2022 standard and preferred voltage ride-through requirements and will no longer be granted an exemption.  ERCOT believes the proposed requirements will improve several of the major failure modes identified in the Odessa disturbances in 2021 and 2022. 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. Additional revision requests are needed to further address issues such as Subsynchronous Resonance(SSR)/ controls speed capabilities, phase angle, rate-of-change-of-frequency, and multiple excursion requirements. 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) and Type 1 and Type 2 Wind-Powered Generation Resources (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 individual Generation Resources or ESRs from the ERCOT System meets or exceeds the following requirements:

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| **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 Generation Resource or ESR, they shall perform such that the automatic removal of individual Generation Resources or ESRs from the ERCOT System meets or exceeds the following requirements:

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| **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 installed and activated to trip a Generation Resource or ESR, frequency protection schemes 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 that inability, including study results or manufacturer advice. The limitation description shall include the Generation Resource’s or ESR’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) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs)***

(1) All IBRs and Type 1 and Type 2 Wind-powered Generation Resources (WGRs) interconnected to the ERCOT Transmission Grid shall ride through the frequency conditions at the IBR’s Point of Interconnection Bus (POIB) specified in the following table:

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| --- | --- |
| 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 or Type 1 WGR or Type 2 WGR to trip for frequency conditions beyond those for which ride-through is required.

(3) If installed and activated to trip the IBR or Type 1 WGR or Type 2 WGR, all protection systems (including, but not limited to protection for over-/under-frequency, rate-of-change of frequency, anti-islanding, and phase angle jump) shall enable the IBR or Type 1 WGR or Type 2 WGR to ride through frequency conditions beyond those defined in paragraph (1) above to the maximum extent the equipment allows.

(4) An IBR or Type 1 WGR or Type 2 WGR shall inject electric current during all periods requiring ride-through.

(5) An IBR or Type 1 WGR or Type 2 WGR plant controls or inverter controls shall not disconnect the IBR or Type 1 WGR or Type 2 WGR from the ERCOT System or reduce output during frequency conditions where ride-through is required unless necessary for providing appropriate frequency response.

(6) The Resource Entity or Interconnecting Entity (IE) for each IBR or Type 1 WGR or Type 2 WGR with a Standard Generation Interconnection Agreement (SGIA) executed prior to June 1, 2023, shall ensure its frequency ride-through capability is maximized to the extent 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 with all available and known commercially reasonable upgrades as set forth in Section 2.11, Commercially Reasonable Efforts.



(7) If an IBR or Type 1 WGR or Type 2 WGR with an original SGIA executed prior to June 1, 2023 cannot fully meet the performance requirements in paragraphs (1) through (5) above by December 31, 2025, but could fully meet the requirements by December 31, 2027, the Resource Entity or IE shall, by February 1, 2025 (or later as part of the interconnection process for any project not approved to energize as of February 1, 2025), request an extension consistent with Section 2.12, Exemptions, Extensions and Appeal Process.

(8) If an IBR or Type 1 WGR or Type 2 WGR with an original SGIA executed prior to June 1, 2023 cannot fully meet the performance requirements in paragraphs (1) through (5) above by December 31, 2027, the Resource Entity shall, by February 1, 2025, request a limited technical exemption consistent with Section 2.12.



(9) If an IBR or Type 1 WGR or Type 2 WGR fails to perform in accordance with the applicable frequency ride-through requirements, the Resource Entity shall: (i) investigate the event; (ii) report to ERCOT the cause of the failure; (iii) perform model validation; (iv) within 90 days of the failure, provide to ERCOT a mitigation plan to meet the applicable frequency ride-through requirements as soon as practicable but no longer than 12 months from the date the mitigation plan is submitted unless ERCOT allows a longer timeframe; and (v) timely implement the mitigation plan. Impacted Transmission Service Providers (TSPs) shall provide available information to ERCOT to assist with event analysis.

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

(1) This Section applies to IBRs and Type 1 and Type 2 WGRs with an SGIA executed prior to June 1, 2023 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) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs).

(2) IBRs and Type 1 WGRs and Type 2 WGRs shall ride through the frequency conditions at the POIB specified in the following table:

|  |  |
| --- | --- |
| **Frequency Range** | **Delay to Trip** |
| 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 |
| 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) This Section shall not affect the Resource Entity’s responsibility to protect equipment from damaging operating conditions. The Resource Entity for an IBR or Type 1 WGR or Type 2 WGR subject to paragraph (2) above that is unable to remain reliably connected to the ERCOT System as set forth in paragraph (2), shall provide to ERCOT the reason(s) for that inability, including study results or manufacturer advice. The limitation description shall include the IBR or Type 1 WGR or Type 2 WGR frequency ride-through capability in the format shown in the table in paragraph (2) above.

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| ***[NOGRR245: Delete Section 2.6.2.1.1 above on January 1, 2026.]*** |











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

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

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

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

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

**2.9 Voltage Ride-Through Requirements for Generation Resources**

(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) and Type 1 and Type 2 Wind-Powered Generation Resources (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 terminal voltages are within 5% of the rated design voltage and volts per hertz are less than 105% of generator rated design voltage and frequency;

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

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

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

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

(2) During operating conditions listed in paragraph (1) above, each Generation Resource 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.

(3) 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.

(4) 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 Protection and Relay Requirements.

(5) The voltage ride-through requirements do not apply to faults between the generator terminals and the transmission voltage side of the Main Power Transformer (MPT), or when clearing the fault effectively disconnects the Generation Resource from the ERCOT System.

(6) 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).

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

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| ***[NOGRR204: Replace Section 2.9 above with the following upon system implementation of NPRR989:]***  **2.9 Voltage Ride-Through Requirements for Generation Resources and Energy Storage Resources**  (1) 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) and Type 1 and Type 2 Wind-Powered Generation Resources (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 it is consuming active power from the ERCOT System when operating in the charging mode, shall reduce or cease power consumption as necessary to aid in voltage recovery during and following transient voltage disturbances.  (4) Synchronous Generation Resources required to provide Voltage Support Service (VSS) shall have and maintain the following capability:  (a) Over-excitation limiters shall be provided and coordinated with the thermal capability of the generator field winding and protective relays in order to permit short-term reactive capability that allows at least 80% of the unit design standard (ANSI C50.13-1989), as follows:  Time (seconds) 10 30 60 120  Field Voltage % 208 146 125 112  After allowing temporary field current overload, the limiter shall operate through the automatic AC voltage regulator to reduce field current to the continuous rating. Return to normal AC voltage regulation after current reduction shall be automatic. The over-excitation limiter shall be coordinated with the over-excitation protection so 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, Generation Resource and Energy Storage Resource Protection and Relay Requirements.  (6) The voltage ride-through requirements do not apply to faults at or behind the POI, when clearing the fault effectively disconnects the 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 owner 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) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs)***

(1) Unless granted an exemption or extension pursuant to Section 2.12, Exemptions, Extensions and Appeal Process, Inverter-Based Resources (IBRs), Type 1 Wind-powered Generation Resources (WGRs), and Type 2 WGRs interconnected to the ERCOT Transmission Grid shall comply with voltage ride-through requirements as follows:

(a) For an IBR, Type 1 WGR, or Type 2 WGR with a Standard Generation Interconnection Agreement (SGIA) dated before June 1, 2023:

(i) Unless otherwise specified below, it shall meet the requirements in Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs);

(ii) If the IBR implements any modification governed by paragraph (1)(c) of Planning Guide Section 5.2.1, Applicability, it shall meet or exceed the requirements in: (i) Section 2.9.1.1, Preferred Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and (ii) Section 5, Reactive power-voltage control requirements within the continuous operation region, Section 7, Response to TS abnormal conditions, and Section 9, Protection, 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”) including any intra-standard cross references or definitions, unless otherwise clarified, modified, or exempted in the Protocols, these Operating Guides, or the Planning Guide;

(iii) If the IBR implements any modification, including a modification governed by paragraph (1)(c) of Planning Guide Section 5.2.1, to meet or exceed the requirements in Section 2.9.1.2 prior to January 1, 2028, the IBR need not meet requirements in the IEEE 2800-2022 standard not required in the Protocols, these Operating Guides, or the Planning Guide (any IBR modification implemented on or after January 1, 2028 does not qualify for this exemption);

(iv) The addition of co-located Load as a modification governed by paragraph (1)(c) of Planning Guide Section 5.2.1, shall not require the IBR to meet or exceed the requirements in Section 2.9.1.1 or the IEEE 2800-2022 standard 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 requirement due to the co-located Load; and

(v) Type 1 and Type 2 WGRs are not required to meet or exceed the capability and performance requirements in Section 2.9.1.1 or the IEEE 2800-2022 standard.

(b) IBRs, Type 1 WGRs or Type 2 WGRs with an SGIA executed on or after June 1, 2023:

(i) Must meet the requirements in Section 2.9.1.1 and the requirements in the IEEE 2800-2022 standard, unless otherwise clarified, modified, or exempted in the Protocols, these Operating Guides, or the Planning Guide;

(ii) An IBR that cannot meet the capability and performance requirements in the IEEE 2800-2022 standard by its synchronization date, the Resource Entity or Interconnecting Entity (IE) may request a temporary extension up to December 31, 2028 or 24 months after the Resource’s Commercial Operations Date, whichever is earlier, consistent with Section 2.12, Exemptions, Extensions and Appeal Process; and

(iii) The Resource Entity or IE for an IBR with an anticipated or actual Commercial Operations Date prior to December 31, 2026 and cannot fully meet the IEEE 2800-2022 standard may request a limited technical exemption consistent with Section 2.12; provided, however, the exemption will terminate on January 1, 2027 if the IBR’s actual Commercial Operations Date is after December 31, 2026.

(c) A Type 3 WGR with an original SGIA dated prior to June 1, 2023 that implements a modification governed by paragraph (1)(c) of Planning Guide Section 5.2.1 that cannot fully meet the requirements in Table 11 - Voltage ride-through requirements at the RPA for IBR plants with auxiliary equipment that cause ride-through limitations, of the IEEE 2800-2022 standard, the Resource Entity may request a limited technical exemption consistent with Section 2.12.

(2) All IBR plant requirements and unit requirements described in the IEEE 2800-2022 standard apply at the Point of Interconnection Bus (POIB) and the individual inverter based resource unit terminal, respectively, unless otherwise clarified, modified, or exempted in the Protocols.

(3) “Ride-through” means the IBR, Type 1 WGR or Type 2 WGR plant and all its individual IBR or WGR units remain electrically connected (i.e. do not trip) to the ERCOT Transmission Grid, continue to inject current as required and otherwise perform as required during and after voltage and frequency disturbances that deviated outside of the continuous operating regions.

(4) Unless approved by ERCOT, no existing IBR, Type 1 WGR or Type 2 WGR with a documented exemption shall reduce the ride-through capability of the unit below its capability prior to the replacement or modification. Unless approved by ERCOT, no existing IBR, Type 1 WGR or Type 2 WGR without a documented limited technical exemption to applicable requirements shall reduce the ride-through capability of the unit below the required ride-through capability.

(5) When an IBR or Type 1 WGR or Type 2 WGR is unable to ride-through any disturbance where the POIB voltage remains within its applicable performance requirements, ERCOT or the Transmission Operator (TO) may require the IBR, Type 1 WGR or Type 2 WGR to disconnect from the ERCOT Transmission Grid until the Resource Entity resolves the reliability issue.

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

(1) All IBRs 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) and Type 1 and Type 2 Wind-powered Generation Resources (WGRs), 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 | (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 region is inclusive of any amount of time the POIB voltage is below the specified voltage region. In the event of multiple excursions, the minimum ride-through time in Tables A and 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 and 0.095625 p.u. and 0.25 p.u. in Table B, 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.

(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 installed and activated to trip the IBR, all protection systems (including, but not limited to protection for over-/under-voltage, rate-of-change-of-frequency, anti-islanding, and phase angle jump) shall enable the IBR to ride through voltage conditions beyond those defined in paragraph (1) above to be maximized to the extent the equipment allows.

(4) An IBR shall inject electric current during all periods requiring ride-through. When the POIB voltage is outside the continuous operating voltage region, 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 region. ERCOT, at 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 or inverter controls shall not disconnect the IBR from the ERCOT System or reduce IBR output during voltage conditions where ride-through is required unless necessary to provide appropriate frequency response.

(6) If installed and activated to trip the IBR, instantaneous over-current or over-voltage protection systems 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 region 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 region within any ten second period.

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

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

(d) Voltage deviations outside of continuous operation region following the end of a previous deviation outside of continuous operation region 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.

(g) Individual wind turbines may trip for consecutive voltage deviations resulting in stimulation of mechanical resonances exceeding equipment limits.

Individual voltage deviations begin when the voltage at the POIB drops below the lower limit or exceeds the upper limit of the continuous operation region. 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) If an IBR cannot fully meet the performance requirements in paragraph (7) above by its synchronization date, but could fully meet the requirements by December 31, 2028, the Resource Entity or IE shall request an extension consistent with Section 2.12, Exemptions, Extensions and Appeal Process.

(10) If a Type 3 WGR cannot fully meet the performance requirements in Tables A and C in paragraph (1) above by its synchronization date, but could fully meet the requirements by December 31, 2028, the Resource Entity or IE shall request an extension consistent with Section 2.12.

(11) If an IBR fails to perform in accordance with the applicable voltage ride-through requirements, the Resource Entity shall: (i) investigate the event (ii) report to ERCOT the cause of the failure (iii) perform model validation (iv) within 90 days of the failure, provide to ERCOT a mitigation plan to meet the applicable voltage ride-through requirements as soon as practicable but no longer than 12 months from the date the mitigation plan is submitted unless ERCOT allows a longer timeframe and (v) timely implement the mitigation plan. Impacted TSPs shall provide available information to ERCOT to assist with event analysis.

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

(1) All IBRs and Type 1 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) and Type 1 and Type 2 Wind-powered Generation Resources (WGRs), shall ride through the root-mean-square voltage conditions in Table A below as measured at the IBR’s POIB:

**Table A**

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

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

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

(3) If installed and activated to trip the IBR or Type 1 WGR or Type 2 WGR, all protection systems (including, but not limited to protection for over-/under-voltage, rate-of-change-of-frequency, anti-islanding, and phase angle jump) shall enable the IBR or Type 1 WGR or Type 2 WGR to ride through voltage conditions beyond those defined in paragraph (1) above to be maximized to the extent the equipment allows.

(4) An IBR or Type 1 WGR or Type 2 WGR shall inject electric current during all periods requiring ride-through. When the POIB voltage is outside the continuous operating voltage region, 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 or 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 region. Slower real power injection recovery rates may be allowed if necessary for reliability as documented by the impacted TSP or ERCOT.

(5) An IBR or Type 1 WGR or Type 2 WGR plant controls, turbine controls, or inverter controls shall not disconnect the IBR or Type 1 WGR or Type 2 WGR from the ERCOT System or reduce its output during voltage conditions where ride-through is required unless necessary for providing appropriate frequency response.

(6) If installed and activated to trip the IBR or Type 1 WGR or Type 2 WGR, instantaneous over-current or over-voltage protection systems 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) An IBR or Type 1 WGR or Type 2 WGR shall ride through any fault disturbance where the POIB voltage remains within the ride-through profiles specified in paragraph (1) above or within the documented maximum ride-through capability for an IBR or Type 1 WGR or Type 2 WGR with a documented technical exemption as specified in paragraph (10) below. 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 or Type 1 WGR or Type 2 WGR during fault conditions.

(8) The Resource Entity or IE for each IBR or Type 1 WGR or Type 2 WGR with an SGIA executed prior to June 1, 2023, shall ensure its voltage ride-through capability is maximized to the extent the equipment allows to meet or exceed the requirements of paragraphs (1) through (7) above as soon as practicable but no later than December 31, 2025 with all available and known commercially reasonable upgrades as set forth in Section 2.11, Commercially Reasonable Efforts.

(9) If an IBR or Type 1 WGR or Type 2 WGR with an original SGIA executed prior to June 1, 2023 cannot fully meet the performance requirements in paragraphs (1) through (7) above by December 31, 2025, but could fully meet the requirements by December 31, 2027, the Resource Entity or IE shall, by February 1, 2025 (or later as part of the interconnection process for any project not approved to energize as of February 1, 2025), request an extension consistent with Section 2.12 Exemptions, Extensions and Appeal Process.

(10) An IBR or Type 1 WGR or Type 2 WGR with an original SGIA executed prior to June 1, 2023 that cannot fully meet the performance requirements in paragraphs (1) through (7) above by December 31,2027, the Resource Entity shall, by February 1, 2025, request a limited technical exemption consistent with Section 2.12.

(11) If an IBR or Type 1 WGR or Type 2 WGR fails to perform in accordance with the applicable voltage ride-through requirements, the Resource Entity shall: (i) investigate the event (ii) report to ERCOT the cause of the failure (iii) perform model validation (iv) within 90 days of the failure, provide to ERCOT a mitigation plan to meet the applicable voltage ride-through requirements as soon as practicable but no longer than 12 months from the date the mitigation plan is submitted unless ERCOT allows a longer timeframe and (v) timely implement the mitigation plan.. Impacted TSPs shall provide available information to ERCOT to assist with event analysis.







**2.11** **Commercially Reasonable Efforts**

(1) Any references to “commercially reasonable” in Section 2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), and Section 2.12 Exemptions, Extensions and Appeal Process, refer to this Section 2.11, Commercially Reasonable Efforts.

(2) Each Resource Entity or Interconnecting Entity (IE) shall, for each applicable Inverter-Based Resource (IBR), Type 1 Wind-powered Generation Resource (WGR) and Type 2 WGR, implement “commercially reasonable” modifications to comply with or increase the level of compliance with the requirements of Section 2.6, Requirements for Under-Frequency and Over- Frequency Relaying, and Section 2.9, Voltage Ride-Through Requirements For Generation Resources.  The Resource Entity or IE must evaluate its facilities and the modifications it can make to its equipment, if any, to comply with such requirements or maximize its frequency ride-through and voltage ride-through capability; provided, however:

(a) Technically feasible modifications requiring only software, firmware, settings or parameterization changes are deemed “commercially reasonable” unless ERCOT and the Resource Entity or IE mutually agree the pricing for the modification is unreasonable. The Resource Entity or IE shall implement commercially reasonable modifications as soon as practicable but no longer than 12 months after the date on which the modification becomes available unless a longer time is required by an impacted Transmission Service Provider (TSP) or as mutually agreed by the Resource Entity or IE and ERCOT. The Resource Entity or IE may request an extension for circumstances beyond its reasonable control and shall provide ERCOT an updated schedule for applying the modifications.

(b) The Resource Entity or IE shall determine if any technically feasible modification requiring more than only software, firmware, settings or parameterization changes are commercially reasonable. The Resource Entity or IE shall implement commercially reasonable changes other than software, firmware, settings or parameterization changes as soon as practicable but no later than 24 months after the date on which the modification becomes available unless a longer time is required by an impacted TSP or as mutually agreed by the Resource Entity or IE and ERCOT. The Resource Entity or IE may request an extension for circumstances beyond its reasonable control and shall provide ERCOT an updated schedule for applying the modification.

(c) Efforts to maximize frequency ride-through and voltage ride-through capability beyond any required performance requirements may be subject to equipment limitations and made in accordance with original equipment manufacturer guidance.

(3) When determining whether any equipment modifications beyond software, firmware, settings or parameterization changes are commercially reasonable, the Resource Entity or IE may consider the availability or cost of hardware; whether the improvements modifications are technically feasible; the facility’s depreciated value; cost of capital; the facility’s expected profitability for the remainder of its expected operational life; any potential compliance or operational risk; and ERCOT or its interconnecting TSP input on whether the modification materially enhances frequency ride-through or voltage ride-through capabilities. The Resource Entity or IE for an IBR, Type 1 WGR, or Type 2 WGR may install supplemental dynamic reactive devices or batteries to provide sufficient leading and lagging dynamic Reactive Power to meet all Reactive Power requirements and the applicable ride-through requirements.

(4) No later than February 1st of each year beginning February 1, 2026, each Resource Entity that owns an IBR or Type 1 WGR or Type 2 WGR with a documented technical exemption, must submit a detailed report and supporting documentation to ERCOT through the Resource Integration and Ongoing Operations (RIOO) system containing:

(a) A description of the potential modifications to improve ride-through capability the Resource Entity considered and whether it is commercially reasonable to implement any potential modification;

(b) The current and predicated post-modification ride-through capability in a tabular format similar to the ride-through requirements for each potential modification regardless of whether it is commercially reasonable;

(c) A schedule for implementing modifications in accordance with the timeframes in paragraph (2) above;

(d) For any potential modification not deemed commercially reasonable, the rationale and supporting documentation for that determination;

(e) A description of the efforts made since the date of the previous report to identify technically feasible modifications to comply with the voltage ride-through and frequency ride-through requirements; and

(f) An attestation signed by an officer or executive with authority to bind the Resource Entity or a Board of Directors resolution that the contents of the report are accurate and all models the Resource Entity provided to ERCOT continue to represent documented technical limitations capable of being represented in those models and a description of known limitations that cannot be represented in a model.

(5) Resource Entities must make good faith efforts to actively seek solutions to allow their facilities to comply with the voltage ride-through and frequency ride-through requirements. Additionally, Resource Entities must take all steps reasonably necessary to encourage original equipment manufacturers (or subsequent vendor support company if the original equipment manufacturer is no longer in business) to continue developing solutions to allow existing facilities to comply with all voltage ride-through and frequency ride-through requirements.

(6) If ERCOT believes a commercially reasonable modification is available for a particular Resource other than as identified by the Resource Entity, it will follow the process described in Section 2.12.2, Commercially Reasonable Determination.

**2.12 Exemptions, Extensions and Appeal Process**

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

(1) If a Resource Entity or Interconnecting Entity (IE) for an Inverter-Based Resource (IBR) requests a limited technical exemption to fully meeting the frequency ride-through and voltage ride-through requirements consistent with paragraph (8) of Section 2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), paragraphs (1)(b)(iii) and (1)(c) of Section 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-powered Generation Resources (WGRs) and paragraph (10) of Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), it shall submit documentation to ERCOT through the Resource Integration and Ongoing Operations (RIOO) system unless ERCOT specifies otherwise. The information provided to ERCOT must demonstrate to ERCOT’s satisfaction the Resource Entity or IE has maximized the ride-through capability with all available commercially reasonable upgrades and accurately represented the limitation in models provided to ERCOT. ERCOT will not grant an exemption that substantially lowers the frequency ride-through or voltage ride-through requirements below those in effect on April 1, 2024.  For any IBR, Type 1 WGR or Type 2 WGR with an approved limited technical exemption, the documented maximum capabilities will become the new performance requirements.  The Resource Entity or IE shall, at a minimum, submit the following information: (i) documentation describing the technical limitation, including a letter signed by an officer or executive of the original equipment manufacturer (or subsequent inverter/turbine vendor support company if the original equipment manufacturer is no longer in business or engineering consulting firms) verifying the need for an exemption; (ii) documentation describing any commercially reasonable modifications that were or will be implemented; (iii) documentation and rationale for determining if any technically feasible modifications were determined to not be commercially reasonable; (iv) a model accurately representing all technical limitations; (v) a description of any limitation that cannot be accurately represented in a model; (vi) data and information identified in paragraphs (a) through (d) below; and (vii) any other data or information ERCOT reasonably deems necessary to evaluate granting the limited technical exemption.

(a) If a Resource Entity or IE for an IBR requests a limited technical exemption to fully meeting the frequency ride-through requirements as described in paragraph (8) of Section 2.6.2.1, it shall also provide to ERCOT the current frequency ride-through capability and predicted post-modification frequency ride-through capability that represents the new alternative performance requirements in a format similar to the table in paragraph (1) of Section 2.6.2.1.

(b) If a Resource Entity or IE for an IBR requests a limited technical exemption to fully meet the performance requirements in 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 (1)(b)(iii) of Section 2.9.1, it shall also provide its actual or reasonable anticipated Commercial Operations Date.

(c) If a Resource Entity or IE for a Type 3 WGR requests a limited technical exemption to fully meet Table 11 - Voltage ride-through requirements at the RPA for IBR plants with auxiliary equipment that cause ride-through limitations, of the IEEE 2800-2022 standard as described in paragraph (1)(c) of Section 2.9.1, it shall also provide to ERCOT documented evidence of technical infeasibility from its original equipment manufacturer (or subsequent inverter/turbine vendor support company if the original equipment manufacturer is no longer in business) and that it maximized its voltage ride-through capability with the best converter upgrade available along with any subsequent modifications and demonstrates it substantially meets the low voltage ride-through curve regions of Table 11 of the IEEE 2800-2022 standard.

(d) If a Resource Entity or IE for an IBR requests a limited technical exemption to fully meeting the voltage ride-through requirements described in paragraph (10) of Section 2.9.1.2, it shall also provide to ERCOT the current voltage ride-through capability and predicted post-modification voltage ride-through capability that represents the new alternative performance requirements in a format similar to Table A in paragraph (1) of Section 2.9.1.2.

(2) If a Resource Entity or IE for an IBR requests an extension to meet the frequency ride-through or voltage ride-through requirements consistent with paragraph (7) of Section 2.6.2.1, paragraph (1)(b)(ii) of Section 2.9.1, paragraphs (9) and (10) of Section 2.9.1.1, and paragraph (9) of Section 2.9.1.2, it shall submit documentation to ERCOT through the RIOO system unless ERCOT specifies otherwise. The information provided to ERCOT must demonstrate to ERCOT’s satisfaction the Resource Entity or IE has made best efforts to meet the original required timelines, maximized its ride-through capability during the extension period and accurately represented the current ride-through capabilities in models provided to ERCOT.  For any IBR, Type 1 WGR or Type 2 WGR with an approved extension, the documented maximum capabilities will become the new performance requirements until the extension has ended.  The Resource Entity or IE shall, at a minimum, submit the following information: (i) documentation describing the justification for granting the extension, including a letter signed by an officer or executive of the Resource Entity or IE; (ii) a model accurately representing all technical limitations; (iii) a description of any limitation that cannot be accurately represented in a model; (iv) data and information identified in paragraphs (a) through (e) below; and (v) any other data or information ERCOT reasonably deems necessary to evaluate granting the extension.

(a) If a Resource Entity or IE for an IBR requests an extension to meet the frequency ride-through requirements as described in described in paragraph (7) of Section 2.6.2.1, it shall provide to ERCOT supporting documentation containing the following:

(i) The proposed commercially reasonable modification(s) to maximize the IBR, Type 1 WGR or Type 2 WGR frequency ride-through capability and allow it to comply with the applicable frequency ride-through requirements in paragraphs (1) through (5) of Section 2.6.2.1 or alternative performance requirements pursuant to a documented limited technical exemption consistent with paragraph (1) above;

(ii) The current and predicted post-modification frequency ride-through capability in a format similar to the table in paragraph (1) of Section 2.6.2.1; and

(iii) A schedule for implementing any commercial reasonable modifications as soon as practicable but no later than December 31, 2027 along with documentation supporting the need for the extension.

(b) If a Resource Entity or IE for an IBR requests an extension to meet the performance requirements in the IEEE 2800-2022 standard as described in paragraph (1)(b)(ii) of Section 2.9.1, it must provide to ERCOT: (i) 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 the IEEE 2800-2022 standard by its synchronization date; (ii) a description of proposed modifications; and (iii) 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.

(c) If a Resource Entity or IE for an IBR requests an extension to meet the performance requirements in paragraph (7) of Section 2.9.1.1, as described in paragraph (9) of Section 2.9.1.1, it must provide to ERCOT: (i) 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 the performance requirements in paragraph (7) of Section 2.9.1.1 by its synchronization date; (ii) a description of proposed modifications; and (iii) the schedule for implementing those modifications. Any temporary extensions shall be minimized and not extend beyond December 31, 2028.

(d) If a Resource Entity or IE for an IBR requests an extension to meet the performance requirements in Tables A or C in paragraph (1) of Section 2.9.1.1, as described in paragraph (10) of Section 2.9.1.1, it must provide to ERCOT: (i) documented 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 the performance requirements in paragraph (1) of Section 2.9.1.1 by its synchronization date; (ii) a description of proposed modifications; and (iii) the schedule for implementing those modifications. Any temporary extensions shall be minimized and not extend beyond December 31, 2028. ERCOT may 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.

(e) If a Resource Entity or IE for an IBR requests an extension to meet the voltage ride-through requirements described in paragraph (9) of Section 2.9.1.2, it shall provide to ERCOT supporting documentation containing the following:

(i) The proposed commercially reasonable modifications to maximize the IBR, Type 1 WGR or Type 2 WGR voltage ride-through capability and allow it to comply with the applicable voltage ride-through requirements in paragraphs (1) through (7) of Section 2.9.1.2 or alternative performance requirements pursuant to a documented limited technical exemption consistent with paragraph (1) above;

(ii) The current and predicted post-modification voltage ride-through capability for each technically feasible modification in a format similar to Table A in paragraph (1) of Section 2.9.1.2; and

(iii) A schedule for implementing any commercially reasonable modifications as soon as practicable but no later than December 31, 2027, along with documentation supporting the need for the extension.

(3) As soon as practicable after receiving the information in support of an exemption or extension request, ERCOT will inform the Resource Entity or IE if it finds the supporting information acceptable.

(a) If the information is not acceptable, ERCOT shall describe, in writing, why it finds the information unacceptable.

(b) If the information is acceptable, ERCOT shall grant the requested exemption or extension in writing.

(4) If the Resource Entity or IE does not agree with ERCOT’s decision in paragraph (3), above, it shall appeal the 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 purposes of such an appeal, the Resource Entity or IE is not required to comply with Protocol Section 20, Alternative Dispute Resolution Procedure and Procedure for Return of Settlement Funds.

(5) Any technical exemption will expire: (i) when the IBR 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 (ii) when ERCOT and the Resource Entity or IE learn that the technical limitation no longer exists due to a commercially reasonable solution and the Resource Entity or IE has had sufficient time to implement the solution in accordance with Section 2.11, Commercially Reasonable Efforts.  For any IBR, Type 1 WGR or Type 2 WGR with a documented technical exemption or extension, the documented maximum capabilities not meeting the requirements in Sections 2.6.1, 2.9.1, 2.9.1.1, or 2.9.1.2 will become the new performance requirements until the exemption is removed or the extension is no longer active.

(6) For IBRs with an SGIA dated after January 16, 2014, ERCOT shall not grant any exemption:

(a) That, in ERCOT’s opinion, allows substantially less performance than the frequency ride-through or voltage ride-through requirements in effect on April 1, 2024 or that does not comply with North American Electric Reliability Corporation (NERC) Reliability Standards;

(b) That, in ERCOT’s opinion, creates an unacceptable reliability risk to the ERCOT System;

(c) That allows for an IBR, Type 1 WGR, or Type 2 WGR (or its associated IBR unit or wind turbines) to trip for a phase angle jump, rate-of-change-of-frequency or multiple excursions during fault conditions unless otherwise specifically allowed in the Protocols or these Operating Guides;

(d) For which, in ERCOT’s opinion, a commercially reasonable solution can be implemented; or

(e) To address unknown, uncertain or unvalidated limitations due to a lack of information or validation from the original equipment manufacturer.

(8) The Resource Entity for any IBR, Type 1 WGR or Type 2 WGR with a documented technical exemption shall provide through the RIOO system all information required by ERCOT to document the exemption including, without limitation, frequency protection setpoints, voltage protection set points, k factor, attestations, model validation reports, and any other information needed to represent the limitation.

**2.12.2 Commercially Reasonable Determination**

(1) If a Resource Entity or IE informs ERCOT that a potential modification to comply with Section 2.6.2.1, Frequency Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), Section 2.9.1, Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs) or Section 2.9.1.2, Legacy Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-Powered Generation Resources (WGRs), is not commercially reasonable, it must provide to ERCOT the information it used to make that determination in the annual report described in paragraph (4) of Section 2.11, Commercially Reasonable Efforts. ERCOT will treat all financial and proprietary information as Protected Information and inform the Resource Entity or IE whether it agrees with the commercially reasonable determination as soon as practicable.  ERCOT may consider any information in making its determination.

(a) If ERCOT determines the modification is commercially reasonable, it will inform the Resource Entity or IE, in writing, and provide the basis for its decision.

(b) If the Resource Entity or IE does not agree with ERCOT, it shall appeal the decision to the PUCT pursuant to P.U.C. Proc. R. 22.251, Review of Electric Reliability Council of Texas (ERCOT) Conduct. For purposes of such an appeal, the Resource Entity or IE is not required to comply with Protocol Section 20, Alternative Dispute Resolution Procedure and Procedure for Return of Settlement Funds.

(c) During the course of an appeal to the PUCT, the period for implementing the modification (described in paragraph (2)(b) of Section 2.11) shall be suspended. The suspension shall terminate ten days after a PUCT decision on the appeal becomes final.