

Standards Development Consideration of Directives from FERC Order 901

June 2024

Background

The Federal Energy Regulatory Commission (FERC) issued Order No. 901 on October 19, 2023, which includes directives on new or modified NERC Reliability Standard projects. Order No. 901 addresses a wide spectrum of reliability risks to the grid from the application of inverter-based resources (IBR), including both utility scale and behind-the-meter or distributed energy resources. Within the Order, are four milestones that include sets of directives to NERC. The first milestone was achieved on January 17, 2024 as NERC filed its initial work plan to address all aspects of Order No. 901 throughout the next three years.¹ The filed work plan includes extensive detail on Standards Development approach and next steps to accomplish the suite of directives addressing IBR. The work plan was intended to be an initial roadmap to guide development for each of the Reliability Standards Projects identified as a 901-related project.

This document includes specifics for how each directive assigned to Project 2020-02 Modifications to PRC-024 (Generator Ride-through) drafting team have been addressed.

Resources

[FERC Order No. 901 – Final Rule Reliability Standards to Address Inverter-Based Resources](#)

[NERC Mapping Document for FERC Order 901 Directives to Standards Development Projects, Draft SARs, and Pending SARs](#)

¹ INFORMATIONAL FILING OF THE NORTH AMERICAN RELIABILITY CORPORATION REGARDING THE DEVELOPMENT OF RELIABILITY STANDARDS RESPONSIVE TO ORDER NO. 901; 01/17/2024;
https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/NERC%20Compliance%20Filing%20Order%20No%20901%20Work%20Plan_packaged%20-%20public%20label.pdf

Index	Paragraph of Order	Milestone	Directive Subpart Summary	Active Project # Draft SAR # or Pending SAR name	Description of How This Directive has Been Addressed
49	190	2	“Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require registered IBR generator owners and operators to use appropriate settings (i.e., inverter, plant controller, and protection) to ride through frequency and voltage system disturbances and that permit IBR tripping only to protect the IBR equipment in scenarios similar to when synchronous generation resources use tripping as protection from internal faults.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	The new standard PRC-029-1 will require registered generator owners of IBRs to both design and operate their IBR plants to ride through voltage and frequency excursions within “must ride-through zones” according to how these zones are defined in the standard. The must ride-through zones are defined in terms of voltage and frequency magnitude and time duration. Tripping of IBR plants is permitted only outside of the defined must ride-through zones. The voltage and frequency must ride-through zones are based on IEEE 2800-2022 no-trip zones and are established in view of experience with voltage and frequency excursions in planning and operating criteria disturbances, under-frequency load shedding stages, reasonable and practical limits of IBR voltage and frequency tolerances, PRC-024-3 voltage and frequency relay setting graphs, and include adequate margins against worst-case conditions that could be brought about during system disturbances.
50	190	2	“The new or modified Reliability Standards must require registered IBRs to continue to inject current and perform frequency support during a Bulk-Power System disturbance.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	In association with the new PRC-029 standard, a definition of the term <i>ride-through</i> is proposed for addition to the NERC Glossary of Terms that essentially states that IBR facilities must remain connected and continue to fulfill their established control and regulation functions (which generally involve exchange of current) in order to qualify as riding through system disturbances. Support of frequency is predicated on, and to a large degree achieved by the riding through of system disturbances. Frequency regulation (or governing) is presently not a continent-wide necessity and not a requirement on individual generating

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					plants/facilities in NERC standards. RTO/ISO requirements may apply.
51	190	2	“Any new or modified Reliability Standard must also require registered IBR generator owners and operators to prohibit momentary cessation in the no-trip zone during disturbances.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	Momentary cessation, understood as inverter temporary current blocking while still remaining connected, is restricted to only two system conditions: 1) non-fault line switching caused voltage phase angle jumps in excess of 25 degrees that could result in tripping unless the inverter goes into current blocking, and 2) while voltage at the plant-system interface is less than 0.10 per unit during which time it may be difficult or impractical to maintain current exchange.
52	190	2	“NERC must submit new or modified Reliability Standards that establish IBR performance requirements, including requirements addressing frequency and voltage ride through, post-disturbance ramp rates, phase lock loop synchronization, and other known causes of IBR tripping or momentary cessation.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	IBR frequency and voltage ride through requirements are established in the new PRC-029 standard as noted above. A default post-disturbance ramp rate of 1.0 second is specified unless a faster or slower rate is specified by the Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator to accommodate specific system post-disturbance recovery needs. Any Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator specified ramp rate becomes the standard requirement. Tripping due to phase lock loop loss of synchronism is specifically not permitted within voltage and frequency must ride through zones.
53	193	2	“Therefore, we direct NERC through its standard development process to determine whether the new or modified Reliability	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	Exemption from the voltage must ride-through zone requirement of PRC-029-1 is permitted for IBR plants/facilities that are in service at the enforcement date of the standard. The IBR Generator Owner must document the need for an exemption and the documentation must explain what hardware prevents the IBR

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			Standards should provide for a limited and documented exemption for certain registered IBRs from voltage ride through performance requirements.”		from meeting the requirement and must be specific as to what aspect of the voltage must ride-through zone cannot be met. The Compliance Enforcement Authority checks that all aspects of the documentation specified in the standard have been provided by the GO and the GO is required to supply further information on the need for and the nature of the exemption if requested by the Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator. The implementation plan provides a 12-month time window for exemption requests to be submitted following the enforcement date. Following the 12-month window, further exemption requests will either not be accepted or could be considered an admission of non-compliance.
54	193	2	“Further, we direct NERC to ensure that any such exemption would be applicable for only existing equipment that is unable to meet voltage ride-through performance. When such existing equipment is replaced, the exemption would no longer apply, and the new equipment must comply with the appropriate IBR performance requirements specified in the Reliability Standards (e.g., voltage and frequency ride	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	The exemption provision of PRC-029-1 is available only for IBR plants/facilities that are in service at the enforcement date as noted above. The exemption provision also stipulates that once the plant/facility hardware causing the inability to comply with the voltage must ride-through requirement is replaced, the exemption is withdrawn (“no longer applies”).

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			through, phase lock loop, ramp rates, etc.).”		
55	193	2	“Finally, we direct NERC, through its standard development process, to require the limited and documented exemption list (i.e., IBR generator owner and operator exemptions) to be communicated with their respective Bulk-Power System planners and operators (e.g., the IBR generator owner’s or operator’s planning coordinator, transmission planner, reliability coordinator, transmission operator, and balancing authority).”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	The exemption provision of PRC-029-1 requires an IBR Generator Owner to supply its exemption request documentation to its Transmission Planner, Planning Coordinator, Reliability Coordinator, and Transmission Operator within the 12-month window following the enforcement date as noted above.

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56	199	2	“Pursuant to section 215(d)(5) of the FPA, we modify the NOPR proposal. To the extent NERC determines that a limited and documented exemption for those registered IBRs currently in operation and unable to meet voltage ride-through requirements is appropriate due to their inability to modify their coordinated protection and control settings, we direct NERC to develop new or modified Reliability Standards to mitigate the reliability impacts to the Bulk-Power System of such an exemption.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	Mitigation of the reliability impacts of voltage must ride-through exemptions are existing NERC standard responsibilities of Transmission Planners, Planning Coordinators, Reliability Coordinators, and Transmission Operators under TPL, IRO, TOP, and other standards. These entities may need to restrict the operation of exempted IBRs where and when their tripping may result in detrimental reliability impacts.
57	208	2	“Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal and direct NERC to develop and submit to the Commission for approval new or modified Reliability Standards that require post-disturbance ramp rates for registered IBRs to be unrestricted and not	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	As indicated above, a default post-disturbance ramp rate of 1.0 second is specified unless a faster or slower rate is specified by the Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator to accommodate specific system post-disturbance recovery needs. Any Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator specified ramp rate becomes the standard requirement.

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			programmed to artificially interfere with the resource returning to a pre-disturbance output level in a quick and stable manner after a Bulk-Power System.”		
59	209	2	“We direct NERC to submit to the Commission for approval new or modified Reliability Standards that would require registered IBRs to ride through any conditions not addressed by the proposed new or modified Reliability Standards that address frequency or voltage ride through, including phase lock loop loss of synchronism.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	Phase lock loop loss of synchronism is not allowed as a cause of tripping while voltage remains within the must ride-through zone unless there are phase jumps more than 25 degrees caused by non-fault switching events. A footnote under R1 also specifically states that phase lock loop loss of synchronism as not a permissible condition for tripping while voltage remains within the must ride-through zone.
60	209	2	“The proposed new or modified Reliability Standards must require registered IBRs to ride through momentary loss of synchronism during Bulk-Power System disturbances and require registered IBRs to continue to inject current into the Bulk-	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	As indicated above, tripping due to phase lock loop loss of synchronism is specifically not permitted within voltage and frequency must ride-through zones. The requirement to return to pre-disturbance power also includes a provision for return to “available active power” to allow for “changes of facility active power output attributed to factors such as weather patterns, change of wind, and change in irradiance,” but “changes of facility active power attributed to IBR tripping in

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			Power System at pre-disturbance levels during a disturbance, consistent with the IBR Interconnection Requirements Guideline and Canyon 2 Fire Event Report recommendations.”		whole or part” are not permitted. Injecting current at pre-disturbance levels during a disturbance is not always practical or desirable. PRC-029-1 R2 specifies IBR required active and reactive power performance during voltage disturbances.
61	209	2	“Related to ACP/SEIA’s comment recommending to revise the directive to require generators to maintain synchronism where possible and continue to inject current to support system stability, we direct NERC, through its standard development process, to consider whether there are conditions that may limit generators to maintain synchronism.”	Project 2020-02 Modifications to PRC-024 (Generator Ride-through)	IBRs are non-synchronous but can exhibit forms of instability other than loss of synchronism. System stability is a shared responsibility of Transmission Planners, Planning Coordinators, Reliability Coordinators, and Transmission Operators. IBR generation levels may need to be restricted by these entities to maintain system stability including IBR stability.
63A	226	2	“Further, we believe that there is a need to have all of the directed Reliability Standards effective and enforceable well in advance of 2030 and direct NERC to ensure that the associated implementation plans	Each of the identified Reliability Standards Projects in Milestone 2 will include implementation plans that assure	The PRC-029-1 implementation is a staggered implementation beginning twelve months following governmental approval with enforcement of all provisions within the twelve months following approval except as necessary to coordinate with the PRC-028-1 implementation plan that extends to 2030.

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			sequentially stagger the effective and enforceable dates to ensure an orderly industry transition for complying with the IBR directives in this final rule prior to that date.”	all new or modified Reliability Standards are effective and enforceable before 2030.	