



TEXAS RE

**PRC-029-1 & NOGRR245
Comparison and
Category 2 Registration
Practice Guide**

Mark Henry and Eric Newnam

IBRWG

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PRC-029-1 R1 Voltage and Frequency Ride-Through (VRT/FRT)

PRC-029-1

R1. Each Generator Owner shall ensure the design and operation is such that each IBR meets or exceeds Ride-through requirements, in accordance with the “must Ride-through zone” as specified in Attachment 1, except in the following conditions: [Violation Risk Factor: High] [Time Horizon: Operations Assessment]

- The IBR needed to electrically disconnect in order to clear a fault;
- The voltage at the high-side of the main power transformer² went outside an accepted hardware limitation, in accordance with Requirement R4;
- The instantaneous positive sequence voltage phase angle change is more than 25 electrical degrees at the high-side of the main power transformer and is initiated by a non-fault switching event on the transmission system; or
- The Volts per Hz (V/Hz) at the high-side of the main power transformer exceed 1.1 per unit for longer than 45 seconds or exceed 1.18 per unit for longer than 2 seconds.

NERC Technical Rationale mentions alignment with IEEE2800-2022

NOGRR245

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

2.9.1 Voltage Ride-Through Requirements for Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-Powered Generation Resources (WGRs), Type 2 WGRs and Type 3 WGRs

(2) IBR’s with SGIA after August 1, 2024 must meet or exceed IEEE 2800-2022 sections

- (a) Section 5, Reactive power-voltage control requirements within the continuous operation region;
- (b) Section 7, Response to TS abnormal conditions; and
- (c) Section 9, Protection.

Other NOGRR245 sections develop details including exclusions, exemptions, and extensions, as do these Sections of IEEE2800-2022



PRC-029-1 R2 (VRT)

R2. Each Generator Owner shall ensure the design and operation is such that the voltage performance for each IBR adheres to the following during a voltage excursion, unless a documented hardware limitation exists in accordance with Requirement R4.

2.1 While the voltage at the high-side of the main power transformer remains within the continuous operation region as specified in Attachment 1, each IBR shall:

2.1.1 Continue to deliver the pre-disturbance level of Real Power or available Real Power, whichever is less.

2.1.2 Continue to deliver Reactive Power up to its Reactive Power limit and according to its controller settings.

2.1.3 Prioritize Real Power or Reactive Power when the voltage is less than 0.95 per unit, the voltage is within the continuous operating region, and the IBR cannot deliver both Real Power and Reactive Power due to a current limit or Reactive Power limit, unless otherwise specified through other mechanisms by an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator.

2.2 While voltage at the high-side of the main power transformer is within the mandatory operation region as specified in Attachment 1, each IBR shall exchange current, **up to the maximum capability to provide voltage support**, on the affected phases during both symmetrical and asymmetrical voltage disturbances, either under⁶:

- Reactive Power priority by default; or

- Real Power priority if required through other mechanisms by an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator.

2.3 While voltage at the high-side of the main power transformer is within the permissive operation region, as specified in Attachment 1, each IBR may operate in current blocking mode if necessary to avoid tripping. Otherwise, each IBR shall follow the requirements for the mandatory operation region in Requirement R2.2.

2.3.1 If an IBR enters current blocking mode, it shall restart current exchange in less than or equal to five cycles of positive sequence voltage returning to a continuous operation region or mandatory operation region.

2.4 Each IBR shall not itself cause voltage at the high-side of the main power transformer to exceed the applicable high voltage thresholds and time durations in its response as voltage recovers from the mandatory or permissive operation regions to the continuous operation region.

2.5 Each IBR shall restore Real Power output to the pre-disturbance or available level (whichever is lesser) within 1.0 second when the voltage at the high-side of the main power transformer returns from the mandatory operation region or permissive operation region (including operating in current blocking mode) to the continuous operation region, as specified in Attachment 1, unless an associated Transmission Planner, Planning Coordinator, Reliability Coordinator, or Transmission Operator requires a lower post-disturbance Real Power level requirement or requires a different post-disturbance Real Power restoration time through other mechanisms.

Similar details (and more) in NOGRR245 2.9.1(8) and 2.9.1.1(4) or IEEE2800-2022 Section 7. Highlight is the only mention of maximizing capability, with limited applicability vs. NOGRR245's



PRC-029-1 Attachment 1 (Wind IBR VRT)

PRC-029-1

Attachment 1: Voltage Ride-Through Criteria

Table 1: Voltage Ride-through Requirements for AC-Connected Wind IBR ¹³

Voltage (per unit) ¹⁴	Operation Region	Minimum Ride-Through Time (sec)
> 1.20	N/A ¹⁵	N/A
≥ 1.10	Mandatory Operation Region	1.0
> 1.05	Continuous Operation Region	1800
≤ 1.05 and ≥ 0.90	Continuous Operation Region	Continuous
< 0.90	Mandatory Operation Region	3.00
< 0.70	Mandatory Operation Region	2.50
< 0.50	Mandatory Operation Region	1.20
< 0.25	Mandatory Operation Region	0.16
< 0.10	Permissive Operation Region	0.16

NOGRR245

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

- (1) All IBRs subject to this Section shall ride through the root-mean-square voltage conditions in Tables A or B below, as applicable, as measured at the IBR's POIB:

Table A: Applicable to WGR IBRs

Root-Mean-Square Voltage (p.u. of nominal)	Minimum Ride-Through Time (seconds)
$V > 1.20$	May ride-through or trip
$1.10 < V \leq 1.20$	1.0
$0.90 \leq V \leq 1.10$	continuous
$0.70 \leq V < 0.90$	3.0
$0.50 \leq V < 0.70$	2.5
$0.25 \leq V < 0.50$	1.2
$0.005625 \leq V < 0.25$	$(V+0.084375)/0.5625$
$V < 0.005625$	0.16

ERCOT preserves portion of legacy curve



PRC-029-1 Attachment 1 (IBR VRT)

PRC-029-1

Attachment 1: Voltage Ride-Through Criteria

Table 2: Voltage Ride-through Requirements for All Other IBR

Voltage (per unit) ¹⁶	Operation Region	Minimum Ride-Through Time (sec)
> 1.20	N/A ¹⁷	N/A
> 1.10	Mandatory Operation Region	1.0
> 1.05	Continuous Operation Region	1800
≤ 1.05 and ≥ 0.90	Continuous Operation Region	Continuous
< 0.90	Mandatory Operation Region	6.00
< 0.70	Mandatory Operation Region	3.00
< 0.50	Mandatory Operation Region	1.20
< 0.25	Mandatory Operation Region	0.32
< 0.10	Permissive Operation Region	0.32

NOGRR245

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

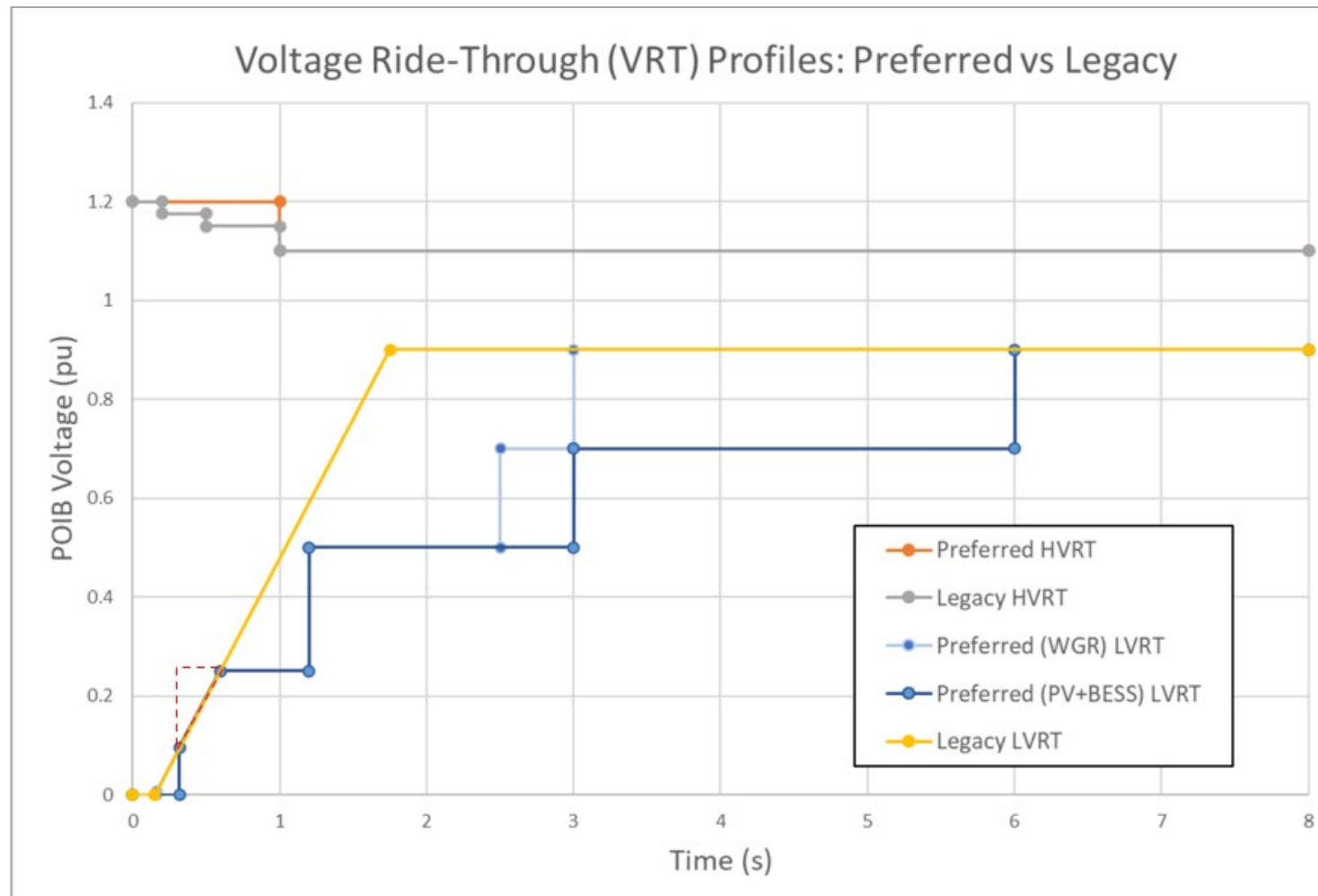
Table B: Applicable to PhotoVoltaic Generation Resources (PVGRs) and ESR IBRs

Root-Mean-Square Voltage (p.u. of nominal)	Minimum Ride-Through Time (seconds)
$V > 1.20$	May ride-through or trip
$1.10 < V \leq 1.20$	1.0
$0.90 \leq V \leq 1.10$	continuous
$0.70 \leq V < 0.90$	6.0
$0.50 \leq V < 0.70$	3.0
$0.25 \leq V < 0.50$	1.2
$0.095625 \leq V < 0.25$	$(V+0.084375)/0.5625$
$V < 0.095625$	0.32

ERCOT preserves portion of legacy curve



PRC-029-1 Attachment 1 Table 2 & NOGRR-245 Table B VRT Curves



PRC-029-1 R3 (FRT)

PRC-029-1

R3. Each Generator Owner shall ensure the design and operation is such that each IBR meets or exceeds Ride-through requirements during a frequency excursion event whereby the System frequency remains within the “must Ride-through zone” according to Attachment 2 and the absolute rate of change of frequency (RoCoF)⁹ magnitude is less than or equal to 5 Hz/second, unless a documented hardware limitation exists in accordance with Requirement R4. *[Violation Risk Factor: High] [Time Horizon: Operations Assessment]*

(Similar RoCoF detail IEEE2800-2022 Section 7.3.2.3.5).

NOGRR245

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

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



PRC-029-1 Attachment 2 (FRT Table)

PRC-029-1

NOGRR245

Table 3: Frequency Ride-through Capability Requirements

System Frequency (Hz)	Minimum Ride-Through Time (sec)
> 61.8	May trip
> 61.2	299
≤ 61.2 and ≥ 58.8	Continuous
< 58.8	299
< 57.0	May trip

NERC Standards changed to align with IEEE2800-2022 Section 7.3.2, Fig 12 and Table 15. ERCOT uses this table (Section 2.6.2.2) for DG/DESR but those facilities are not subject to NERC requirements

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

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

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

ERCOT adds steps between 299-540 seconds to IEEE2800-2022 (Section 7.3.2)



PRC-029-1 Attachment 2 (Distributed Energy Resources – N/A to NERC)

PRC-029-1

NOGRR245

Table 3: Frequency Ride-through Capability Requirements

System Frequency (Hz)	Minimum Ride-Through Time (sec)
> 61.8	May trip
> 61.2	299
≤ 61.2 and ≥ 58.8	Continuous
< 58.8	299
< 57.0	May trip

NERC Standards do not apply generally to distribution connected equipment

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

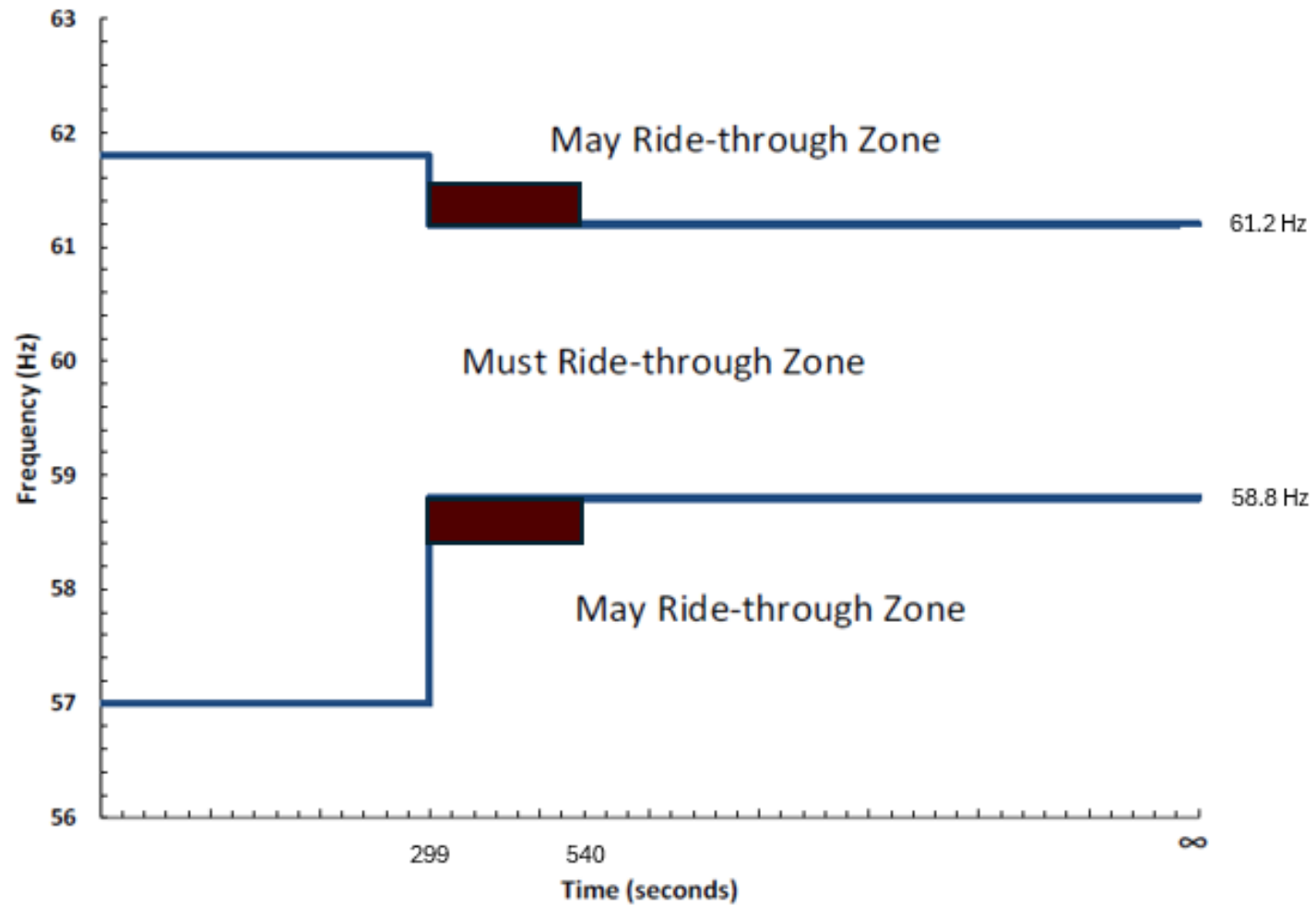
- (1) For any short-circuit fault or open-phase condition that occurs on the circuit to which the DGR or DESR is connected, the DGR or DESR will cease to energize and trip offline, and this will take priority over the frequency ride-through function.
- (2) DGRs and DESRs must have over-/under-frequency 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	
$61.2 < f \leq 61.8$	Mandatory Operation	299
$58.8 \leq f \leq 61.2$	Continuous Operation	continuous
$57.0 \leq f < 58.8$	Mandatory Operation	299
$f < 57.0$	No ride-through requirements	



PRC-029-1 Attachment 2 and NOGRR245 FRT Curve Comparison

- PRC-029-1
- NOGRR245



PRC-029-1 R4 (Hardware-limitation exemptions by CEA)

R4. Each Generator Owner identifying an IBR that is in-service by the effective date of PRC- 029-1, has known hardware limitations that prevent the IBR from meeting Ride-through criteria as detailed in Requirements R1-R3, and requires an exemption from specific Ride-through criteria shall:

- 4.1. Document information supporting the identified hardware limitation no later than 12 months following the effective date of PRC-029-1. This documentation shall include:
 - 4.1.1 Identifying information of the IBR (name and facility number);
 - 4.1.2 Which aspects of Ride-through requirements that the IBR would be unable to meet and the capability of the hardware due to the limitation;
 - 4.1.3 Identification of the specific piece(s) of hardware causing the limitation;
 - 4.1.4 Technical documentation verifying the limitation is due to hardware that would need to be physically replaced to meet all Ride-through criteria, and that the limitation cannot be remedied by software updates or setting changes; and
 - 4.1.5 Information regarding any plans to remedy the hardware limitation (such as an estimated date).
- 4.2. Provide a copy of the information detailed in Requirement R4.1, except for any material considered by the original equipment manufacturer to be proprietary information, to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the Compliance Enforcement Authority (CEA) no later than 12 months following the effective date of PRC-029-1.11
 - 4.2.1 Provide any response for additional information requested by the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), Reliability Coordinator(s), and the CEA to the requestor within 90 days of the request.
 - 4.2.2 Provide a copy of the acceptance of a hardware limitation by the CEA to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s) within 90 days of receiving the acceptance.12
- 4.3. Each Generator Owner with a previously accepted limitation that replaces the hardware causing the limitation shall document and communicate such a hardware change to the associated Planning Coordinator(s), Transmission Planner(s), Transmission Operator(s), and Reliability Coordinator(s) within 90 days of the hardware change.
 - 4.3.1 When existing hardware causing the limitation is replaced, the exemption for that Ride-through criteria no longer applies.

PRC-029 does not have the exemption process steps detailed in NOGRR245 Section 2.11 and 2.12, although R4 has a similar intent

- No August 1, 2024 SGIA date threshold
- Extensions are not included, only exemptions
- Only allowed for **hardware** limitations
- NERC Compliance Enforcement Authority (CEA) makes the determination to grant or deny



Category 2 IBR Registration – Practice Guide Released

ERO Enterprise Webinar

Application of the Registration Criteria for Category 2 Generator Owner and Generator Operator Inverter-Based Resources

March 3, 2025 | 2:00–3:30 p.m. Eastern

Click here for: [Webinar Registration](#) | [Application of the Registration Criteria for Category 2 Generator Owner and Generator Operator Inverter-Based Resources](#)

This informational webinar will review the Practice Guide and address the application of the Category 2 Registration Criteria to identify owners and operators of Inverter-Based Resources (IBRs) that are connected to the bulk power system but are not currently required to register with NERC or adhere to its Reliability Standards under the Bulk Electric System (BES) definition. To mitigate this reliability concern, NERC seeks to register Generator Owners and Generator Operators of non-BES IBRs with aggregate nameplate capacity ≥ 20 MVA connected at a voltage ≥ 60 kV.



The background of the slide features a blurred Texas state flag on the left and a target with several darts on the right. The darts are clustered in the center of the target, suggesting a focus or a goal.

Questions?

Email to: information@texasre.org



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