

Appendix PRC-029-1-QC-1

Specific provisions applicable in Québec for standard

PRC-029-1 – Frequency and Voltage Ride-through Requirements for Inverter-based Resources

This appendix establishes specific provisions for the application of the standard in Québec. Provisions of the standard and of this appendix must be read jointly for comprehension and interpretation purposes. Where the standard and appendix differ, the appendix shall prevail.

A. Introduction

1. **Title:** No specific provisions.
2. **Number:** No specific provisions.
3. **Purpose:** No specific provisions.
4. **Applicability:** In the application of this standard, all reference to the term “Bulk Electric System” or “BES” shall be replaced by the terms “Main Transmission System” or “RTP” respectively.

4.1. Functional Entities:

No specific provisions.

4.2. Facilities:

4.2.1 No specific provisions.

4.2.2 Non-RTP Inverter-Based Resources that either have or contribute to an aggregate nameplate capacity of greater than or equal to 50 MVA, connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage greater than or equal to 44 kV

5. Effective Date:

- | | | |
|-------------|--|------------|
| 5.1. | Adoption of the standard by the Régie de l'énergie: | MM DD YYYY |
| 5.2. | Adoption of the appendix by the Régie de l'énergie: | MM DD YYYY |
| 5.3. | Effective date of the standard and its appendix in Québec: | MM DD YYYY |

The facilities covered by standard PRC-029-1 must comply with the implementation dates indicated in the following table:

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Type of Inverter-Based Resources	Applicability	Date of enforcement in Québec
For requirement R1 to R3		
Capability-Based Elements		
RTP Inverter-Based Resources	Entities shall comply to design-related requirements R1, R2 and R3 for all their Non-RTP Inverter-Based Resources.	No later than the effective date of PRC-029-1
Non-RTP Inverter-Based Resources	Entities shall comply to design-related requirements R1, R2 and R3 for all their Non-RTP Inverter-Based Resources.	At the latest of the following dates: The effective date of PRC-029-1 OR Within three (3) calendar month of the effective date of PRC-029-1
Performance Based-Elements		
For all Inverter-Based Resources	Entities shall comply to operation-related requirements R1, R2 and R3 for all Inverter-Based Resources.	At the time of disturbance monitoring equipment installation for these <i>IBR</i> , in accordance with the implementation of the PRC-028-1 reliability standard
For requirement R4		
RTP Inverter-Based Resources	Entities shall comply to requirements R4 for all their RTP Inverter-Based Resources.	No later than the effective date of PRC-029-1
Non-RTP Inverter-Based Resources	Entities shall comply to requirements R4 for all their Non-RTP Inverter-Based Resources.	At the latest of the following dates: The effective date of PRC-029-1 OR Within three (3) calendar month of the effective date of PRC-029-1
Equipment and processes limitations related to requirement R4 A limited and documented exemption is acceptable for certain existing IBR with duly documented equipment limitations. These IBRs are: " ... typically older IBR technologies whose hardware must be physically replaced and for which settings and configurations cannot be changed via software updates — and which may be unable to implement the performance requirements related to voltage ride-through."		

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To ensure compliance with requirement R4, only IBR in operation on the effective date of standard PRC-029-1 can be considered for a potential exemption.

Furthermore, only IBR that are unable to meet ride-through voltage disturbance requirements due to technical limitations preventing modification of their coordinated protection and control settings may be eligible for a potential exemption.

B. Requirements and Measures

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-through¹ zone” as specified in Attachment 1, except in the following conditions:

Violation Risk Factor: High [*Time Horizon: Operations Assessment*] No specific provisions

- No specific provisions ;
- No specific provisions ;
- No specific provisions ; or
- The Volts per Hz (V/Hz) at the high-side of the main power transformer exceed 1.2 per unit for longer than 45 seconds or exceed 1.32 per unit for longer than 2 seconds.

C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

In Québec, “Compliance Enforcement Authority” means the Régie de l’énergie in its roles of monitoring and enforcing compliance with respect to the Reliability Standard and to this appendix.

1.2. Evidence Retention

No specific provisions.

1.3. Compliance Monitoring and Enforcement Program:

No specific provisions.

Violation Severity Levels

No specific provisions.

D. Regional Variances

No specific provisions.

¹This operating region includes any no-trip band associated with the loss of synchronisation of the phase-locked loop.

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E. Interpretations

No specific provisions.

F. Associated Documents

No specific provisions.

G. References

No specific provisions.

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Attachment 1 : Voltage Ride-Through Criteria

Table 1: Voltage Ride-through Requirements for all IBR²

Voltage (p.u.) ³	Operation Region	Minimum Ride-Through Time (sec)
> 1,40	Mandatory Operation Region	0,033
> 1,25	Mandatory Operation Region	0,1
> 1,20	Mandatory Operation Region	2
≥ 1,15	Mandatory Operation Region	30
> 1,10	Mandatory Operation Region	300
≤ 1,1 and ≥ 0,90	Mandatory Operation Region	Continuous
< 0,90	Mandatory Operation Region	30
< 0,85	Mandatory Operation Region	2,0
< 0,75	Mandatory Operation Region	1,0
< 0,25	Mandatory Operation Region	$3,4 * V \text{ (p.u.)} + 0,15^4$

1. Table 1 applies to every type of IBR, including, but not limited to the following facilities:
 - a. IBR, regardless of their energy resource, interconnecting via a dedicated VSC HVDC transmission facility.
 - b. Other IBR or hybrid IBR consisting of photovoltaic (PV) and BESS, including type 3 and type 4 wind IBR or hybrid IBR that include wind, unless connected via a dedicated Voltage Source Converter - High Voltage Direct Current (VSC-HVDC) transmission facility.
2. Table 2 does not apply in Quebec since Table 1 includes all other IBR mentioned.
3. No specific provisions.
4. No specific provisions.

² Refer to bullet #1 of Attachment 1.

³ Refer to bullet #3 of Attachment 1.

⁴ Refer to bullet #11 of Attachment 1.

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5. The voltage levels indicated in Table 1 apply to the maximum or minimum RMS value of the phase-to-neutral or phase-to-phase fundamental voltages measured on the high-voltage side of the MPT. However, during a ground fault, temporary overvoltages that may occur on one or two phases must not cause tripping, and ride-through is required as long as the RMS value of these temporary overvoltages remains less than or equal to 1.4 p.u., regardless of the minimum ride-through durations specified in Table 1. These requirements also include the ride-through of transient overvoltages, which the peak value can exceed that of the temporary overvoltages.
6. Table 1 is only applicable when the frequency is within the “must Ride-through zone”; as specified in Table 3 of Attachment 2.
7. No specific provisions. Only the bands in Table 1 of Attachment 1 are to be considered as it encompasses all IBR.
8. The specified duration of the mandatory operation regions in Table 1 is cumulative over one or more disturbances within any 10 second time period.
9. No specific revisions.
10. No specific revisions.
11. The “must Ride-through zone” is the combined area of mandatory operating regions and continuous operating regions.
12. To recover from a possible circuit breaker failure on the transmission network, in addition to the time calculated from the equation mentioned, a supplementary ride-through requirement of 150 ms for a residual voltage down to 0 p.u. affecting only one phase (300 ms at 0 p.u. in total).

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Attachment 2: Frequency Ride-Through Criteria

Table 3 : Frequency Ride-through Capability Requirements

System Frequency (Hz)	Minimum Ride-Through Time (sec)
> 61,7	May trip ⁵
> 61,5	90
> 60,6	660
$\leq 60,6$ and $\geq 59,4$	Continuous
< 59,4	660
< 58,5	90
< 57,5	10
< 57,0	2
< 56,5	0,35
< 55,5	May trip

1. No specific provisions.
2. No specific provisions.
3. No specific provisions.
4. No specific provisions.
5. No specific provisions.
6. The minimal frequency applicable is fixed at 61.7 Hz. Nonetheless, when it is possible to do so, it is recommended to keep a minimal frequency of 62 Hz.

⁵ Refer to bullet #6 of Attachment 2.

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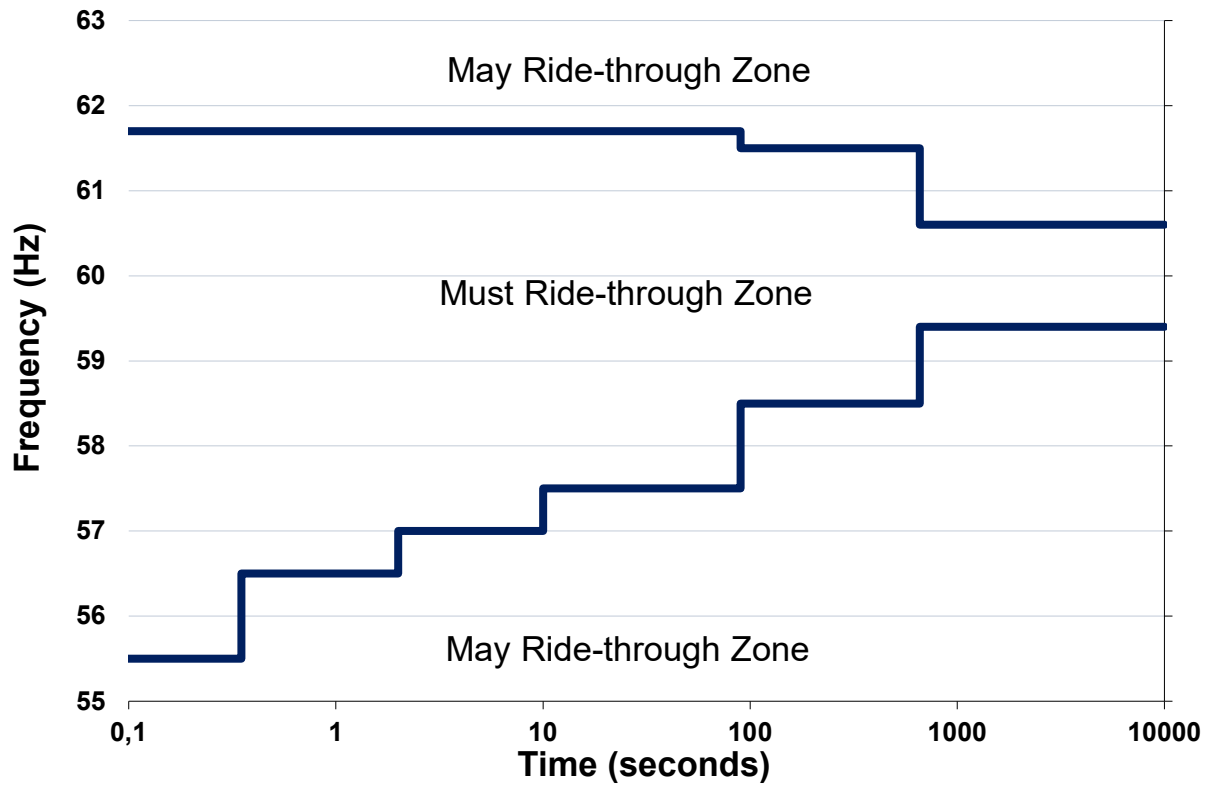


Figure 1: PRC-029 Frequency Ride-through Requirements

Version History

Version	Date	Action	Change Tracking
1	MM DD YYYY	New Appendix as per decision D-2xxx-xxx.	New