

Standard Development Roadmap

This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.

Development Steps Completed:

1. SAR posted for comment (April 20–May 21, 2007).
2. Revised SAR and response to comments posted.
3. Revised SAR and response to comments approved by SC (June 14, 2007).
4. SDT appointed on (August 18, 2007).
5. Initial draft of PRC-024-1 was posted for a 45 day formal comment period (February 17 – April 2, 2009).
6. Draft 2 PRC-024-1 was posted for a 45 day concurrent comment and ballot period from June 15 – August 1, 2011.

Proposed Action Plan and Description of Current Draft:

This is the ~~second~~third draft of the ~~proposed~~ standard including and includes Time Horizons, Data Retention, Violation Risk Factors, and Violation Severity Levels. This second posting ~~of the standard~~ is for a 30-day ~~formal~~ comment and successive ballot period.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Post first <u>Develop responses to comments and develop third version</u> draft revision of standard.	April–May <u>August</u> 2011 – February 2012
2. Post response to comments and third version draft revision of standard <u>for 30 day comment and successive ballot period.</u>	July–August 2011 <u>February – March</u> 2012
3. Post response <u>Develop responses</u> to <u>successive ballot</u> comments and request authorization to ballot the revised standard.	September–October 2011 <u>April – June</u> 2012
4. Conduct initial ballot.	November 2011
5 4. Post response to comments.	December 2011 <u>July</u> 2012

Draft ~~23~~

Date: ~~June 15, 2011~~February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

<u>65</u> . Conduct recirculation ballot.	January <u>July</u> 2012
7. BOT adoption.	February <u>August</u> 2012
8. File with regulatory authorities.	March <u>October</u> 2012

Draft

Definitions of Terms Used in Standard

This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Glossary.

~~**Frequency Excursion**—an exceedance of system frequency beyond a continuous operating band; 60 ± 0.5 Hertz.~~

~~**Voltage Excursion**—an exceedance of system voltage beyond a continuous operating band; $\pm 5\%$ of scheduled voltage.~~

None

Draft

A. Introduction

1. Title: Generator Performance During Frequency and Voltage Excursions

2. Number: PRC-024-1

3. Purpose: Ensure generating units remain connected during frequency and voltage excursions, and ensure expected generating unit performance during frequency and voltage excursions is communicated to Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners for accurate system modeling.

4. Applicability:

1.1.4.1. Generator Owner

5. Effective Date:

~~1.2.5.1.~~ The Each Generator Owner shall verify that at least 33 percent of its applicable units are fully compliant with Requirements R1, R2, R3, R4, and R6 by the first day of the first calendar quarter one year following applicable regulatory approval; or, in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter one year following Board of Trustees adoption.

~~1.2.1~~—Each Generator Owner shall verify that at least ~~33%~~66 percent of its applicable units are fully compliant with ~~this standard.~~

~~1.3.5.2.~~ The Requirements R1, R2, R3, R4, and R6 by the first day of the first calendar quarter two years following applicable regulatory approval; or, in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter two years following Board of Trustees adoption.

~~1.3.1~~—Each Generator Owner shall verify that ~~at least 66%~~100 percent of its applicable units are fully compliant with ~~this standard.~~

~~1.4.5.3.~~ The Requirements R1, R2, R3, R4, and R6 by the first day of the first calendar quarter three years following applicable regulatory approval; or, in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter three years following Board of Trustees adoption.

~~1.4.1~~—~~Each Generator Owner shall verify that 100% of its applicable units are fully compliant with this standard.~~

5.4. Requirement R5 shall be effective on the first day of the first calendar quarter six years following applicable regulatory approval; or, in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six years following Board of Trustees adoption.

B. Requirements

- R1.** Each Generator Owner that has generator frequency protective relaying¹ activated to trip its new or existing generating unit or generating plant shall set such protective relaying so that it does not trip perwithin the following operating conditions and relay settings “no trip zone” of PRC-024 Attachment 1, unless the Generator Owner has documented and communicated a non-protection system each equipment limitation in accordance with Requirement R3 for an existing generating unit.² [*Violation Risk Factor: High*] [*Time Horizon: Long-term Planning*]
- ~~1.1. When operating a generating unit or generating plant is allowed to trip within a frequency range of 59.5 Hz to 60.5 Hz, inclusive.~~
- ~~1.2. During the off nominal frequency excursions specified in PRC 024 Attachment 1.~~
- ~~1.3. By instantaneous under frequency relays set at a frequency higher than 57.8 Hz.~~
- ~~1.4. By instantaneous over frequency relays set at a frequency lower than 62.2 Hz.~~
- ~~1.5.1.1. When “no trip zone” if the transmission system frequency rate of change is lessmore than 2.5 Hz/second. sec.~~
- 1.2. A generating unit or generating plant may trip if the protective functions (such as out-of-step or loss-of-field functions) operate due to an impending or actual loss of synchronism or due to instability in power conversion control equipment.
- R2.** Each Generator Owner that has generator voltage protective relaying¹ activated to trip its new or existing generating unit or generating plant ~~or Facility~~ shall set its protective relaying such that it does not trip as a result of a voltage excursion (at the point of

¹ Each Generator Owner is not required to have frequency or voltage protective relaying (~~includes including but not limited to~~ frequency and voltage protective functions for discrete relays, volts per hertz relays evaluated at nominal frequency, impedance relays, voltage controlled overcurrent relays, multi-function protective devices or protective functions within excitation controls control systems that directly trip or provide tripping signals to the generator based on frequency or voltage inputs) installed or activated on its unit.

² To include generators under construction, generators with an executed interconnection agreement or Power Purchase Agreement by the effective date of this standard, or generators with an executed equipment purchase contract and scheduled delivery of major components within 2 years of the effective date of ~~version~~ Requirement R5 of Version 1 of this standard.

interconnection)³) that remains within the “no trip zone” of PRC-024 Attachment 2 caused by an event on the transmission system external to the generating plant per the following operating conditions and relay settings, unless the Generator Owner has documented and communicated a each non-protection system equipment limitation in accordance with Requirement R3 for an existing generating unit or generating plant ~~or generating Facility~~; *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*

2.1. When operating within 95% percent to 105% percent of rated generator terminal voltage and during the transmission system operating conditions defined in PRC-024 Attachment 2, with the following clarifications:

~~2.1.1. For three phase transmission system zone 1 faults with Normal Clearing, set voltage relays based on actual fault clearing times, not to exceed 9 cycles.~~

~~2.1.2.2.1.1.~~ If a Transmission Planner’s study (based on the location specific voltage recovery characteristics) ~~recommends~~allows less stringent voltage relay settings than those ~~is required to meet~~ PRC-024 Attachment 2, set voltage relays either to meet the Transmission Planner’s ~~settings~~voltage recovery characteristics or the ~~settings~~characteristics in PRC-024 Attachment 2.

~~2.1.3.2.1.2.~~ If tripping a generator in accordance with a Special Protection System (SPS) or Remedial Action Scheme (RAS) ~~includes tripping a generator after fault initiation, then setting the SPS or RAS relays to trip the generator even if is acceptable~~ in the “no trip zone” ~~is of~~ PRC-024 Attachment 2 ~~is acceptable~~.

~~2.1.4.2.1.3.~~ If clearing a system fault necessitates disconnecting a generator, then setting relays to trip the generator even if operating this action is acceptable within the “no trip zone” specified in PRC-024 Attachment 2 ~~is acceptable~~.

~~2.1.4.~~ A generating unit or generating plant may trip if the protective functions (such as out-of-step or loss-of-field functions) operate due to an impending or actual loss of synchronism or due to instability in power conversion control equipment.

R3. Each Generator Owner of an existing generating unit or generating plant ~~or Facility~~ shall document each ~~non-protection system~~ equipment limitation (excluding generator frequency and voltage protective relay limitations) that prevents a generating unit, or generating plant, ~~or Facility~~ from meeting the criteria in ~~Requirement~~Requirements R1 or R2 ~~and including study results, experience from an actual event, or manufacturer’s advisory~~ *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*.

³ For the purposes of this standard, point of interconnection means the transmission (high voltage) side of the generator step-up or collector transformer.

R3.3.1. The Generator Owner shall communicate the documented limitation, or the removal of a previously documented limitation, to its Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner within 30 calendar days of identifying the limitation to ensure the accuracy of planning studies and system modeling studies. ~~The equipment limitation expires~~ The existing generating unit or generating plant becomes subject to the full extent of Requirements R1 and R2 coincident with either of the following conditions:

- The equipment causing the limitation is repaired or replaced with equipment that removes the limitation.
- ~~The generating unit continuous~~ equipment causing the limitation is modified or upgraded resulting in an increase of generator nameplate capacity rating increases \geq greater than 10%.

[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]

R4. ~~Within 90 calendar days of receipt of a written inquiry percent (cumulative from the Reliability Coordinator, Planning Coordinator, Transmission Operator, or Transmission Planner regarding an equipment limitation identified in accordance with Requirement R3, the Generator Owner shall provide a written response to the entity that submitted the inquiry. first effective date of this Standard).~~

R5-R4. Each Generator Owner of an existing generating unit or generating plant ~~or generating Facility~~ shall provide an estimate of that unit's performance during Frequency/Voltage Excursions to ~~the~~each requesting entity (Reliability Coordinator, Planning Coordinator, Transmission Operator or Transmission Planner that monitors or models the associated generating unit or generating plant) within ~~30~~60 calendar days of receipt of a written request, to ensure the accuracy of planning studies and system modeling studies. ~~The documentation estimate shall include:~~ *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*

5.1. ~~An estimate of the time duration the existing generating unit or generating plant or Facility will remain connected (considering performance of the auxiliary systems as well as the generator) as a result of a Frequency Excursion frequency excursion or a voltage excursion defined by the curves in PRC-024 Attachment 1 and a Voltage Excursion defined by the curves in PRC-024 Attachment 2 or the voltage or frequency profile at the Point of Interconnection for the generating unit or generating plant or Facility point of the most severe normally cleared Zone 1 fault interconnection described by dynamic simulation provided by the Transmission Planner if this profile is less stringent. If the Generator Owner expects the existing unit, generating plant will remain connected for longer than 10 minutes, the curves in Attachment 2.~~

~~5.2.4.1.~~ An estimated probability in 25% increments that estimate should indicate the existing unit or generating plant ~~or generating Facility will remain connected during a Frequency Excursion defined by the curves in PRC-024 Attachment 1 and a Voltage Excursion defined by the curves in PRC-024 Attachment 2 or the voltage profile at the Point of Interconnection for the generating unit or generating plant or Facility of the most severe normally cleared Zone 1 fault described by dynamic simulation provided by the Transmission Planner if this profile is less stringent than the curves in Attachment 2.~~ is not expected to trip.

~~5.3.4.2.~~ Identification of the ~~basis~~bases for the estimates developed for ~~5.1 and 5.2~~ which may include, but is not limited to: experience, actual event histories, or sound engineering judgment.

~~R6.R5.~~ Each Generator Owner shall design, build, and maintain its new⁴ unit or new generating plant ~~or generating Facility~~ so that it will not trip due to a ~~Frequency Excursion or Voltage Excursion~~frequency excursion or voltage excursion at the ~~Point~~point of ~~Interconnection~~interconnection, caused by an event on the transmission system external to the generating plant, within the parameters set forth in PRC-024 Attachments 1 and 2 and in accordance with the following conditions and exceptions: *[Violation Risk Factor: High] [Time Horizon: Real-time Operations]*

~~6.1.5.1.~~ (condition) When the generating unit or generating plant ~~or generating Facility~~ is operating at or above the minimum sustainable generation threshold.

~~6.1.1.5.1.1.~~ For a generating plant ~~or generating Facility~~ consisting of multiple units with total generation >greater than 75 MVA (gross aggregate nameplate rating), when the ~~Facility-generating plant~~ is producing at least 20% percent of the ~~Facility's rated~~plant's aggregate nameplate capacity ~~and the voltage support equipment is in service.~~

~~6.2.5.2.~~ (~~condition~~exception) For a new generating plant ~~or generating Facility~~ consisting of multiple units less than 20 MVA each with total ~~Facility~~plant generation >75greater than75 MVA (gross aggregate rating), at least 90%10 percent of the individual generating units ~~shall remain connected~~may disconnect as a result of the frequency or voltage excursion.

~~6.3.5.3.~~ (exception) A generating unit or generating plant ~~or generating Facility~~ may operate to a less stringent voltage ride-through performance criterion than the duration curve identified in PRC-024 Attachment 2 based on the location-specific voltage recovery characteristics ~~as specified~~if provided by the Transmission Planner as described in Requirement 2, Part 2.1.1.

⁴ Excluding generators in service prior to the effective date of ~~version~~Requirement R5 of Version 1 of this standard and excluding generators referenced in Footnote 2.

~~6.4.5.4.~~ (exception) A generating unit or generating plant ~~or generating Facility~~ may trip if this action is designed as part of a Special Protection System (SPS) or Remedial Action Scheme (RAS).

~~6.5.5.5.~~ (exception) A generating unit or generating plant ~~or generating Facility~~ may trip if clearing a system fault necessitates disconnecting the generating unit or generating plant ~~or generating Facility~~.

~~6.6.5.6.~~ (exception) A generating unit or generating plant ~~or generating Facility~~ may trip if the Generator Owner has a temporary exemption granted by its Reliability Coordinator based on a documented equipment limitation. The Reliability Coordinator may retroactively grant a temporary exemption for an equipment limitation identified following a plant trip caused by a frequency or voltage excursion if the Generator Owner develops and implements an acceptable Mitigation Plan.

~~6.7.5.7.~~ (exception) A generating unit or generating plant ~~or generating Facility~~ may trip if the protective functions (such as out-of-step or loss-of-field functions) operate due to an impending or actual loss of synchronism or due to instability in power conversion control equipment.

~~R7-R6.~~ Each Generator Owner shall provide its generator protection trip settings to the Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner (that monitors or models the associated unit) ~~its generator protection trip settings as specified by Requirements R1 and R2, and documented equipment limitations as specified by Requirement R3), within 30 calendar days of receipt of a written request for the data, and~~ within 30 calendar days of any change to those trip settings ~~or limitations and within 30 calendar days of a written request for the data,~~ to ensure the accuracy of planning studies and system modeling. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]

C. Measures

~~R8-M1.~~ Each Generator Owner ~~has~~shall have evidence such as dated setting sheets, calibration sheets, or other documentation, that generator frequency protective relays have been set in accordance with Requirement R1.

~~R9-M2.~~ Each Generator Owner ~~has~~shall have evidence such as dated setting sheets, voltage-time curves, calibration sheets, coordination plots or dynamic simulation studies, that generator voltage protective relays have been set in accordance with Requirement R2.

~~R10-M3.~~ Each Generator Owner ~~has~~shall have evidence that it has documented and communicated any equipment limitations (Protection System excluded) that resulted in an exception to Requirements R1 or R2 in accordance with Requirement R3 such as a dated

email or letter that contains such documentation as study results, experience from an actual event, or manufacturer's advisory.

~~M1.~~ Each Generator Owner ~~has evidence such as dated e-mails, mail receipts or other evidence that it provided a written response to an inquiry regarding equipment limitations to a requesting entity within 90 calendar days of a request in accordance with Requirement R4.~~

~~R11.M4.~~ Each Generator Owner ~~has~~ shall have evidence such as a copy of the performance report and correspondence, such as dated e-mails, ~~mail receipts~~ or other documentation that an estimate of the performance of its existing generating unit(s) as a result of a Frequency Excursion or Voltage Excursion has been communicated in accordance with Requirement ~~R5~~R4, and copies of any requests it has received for that information.

~~R12.M5.~~ Each Generator Owner ~~has~~ shall have evidence, such as dated unit output records, trip investigation reports or disturbance monitoring records ~~or a trip report indicating, showing that~~ each unit trip did not result from a Frequency Excursion or Voltage Excursion as specified in Requirement ~~R6~~R5, or evidence that a listed exception applied, or provide an attestation that the generating unit, ~~or~~ generating plant ~~or Facility~~ did not trip.

~~R13.M6.~~ Each Generator Owner ~~has~~ shall have evidence such as dated e-mails, ~~mail receipts~~ correspondence or other evidence that it communicated generator protective relay settings ~~or equipment limitations~~ to a requesting entity within 30 calendar days of a request or change in setting(s) in accordance with Requirement ~~R7~~R6 and copies of any requests it has received for that information..

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

Regional Entity

1.2. Data Retention

The following evidence retention periods identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full time period since the last audit.

The Generator Owner shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation:

- The Generator Owner shall retain the latest evidence of Requirement R1 through ~~R7R6~~, Measure M1 through ~~M7M6~~; and shall retain prior evidence for 3 calendar years or until the next audit, whichever is longer.

If a Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the time period specified above, whichever is longer.

The Compliance Enforcement Authority shall keep the last audit records and all requested and submitted subsequent audit records.

1.3. Compliance Monitoring and Assessment Processes

Compliance Audit

Self-Certification

Spot Checking

Compliance ~~Violation~~ Investigation

Self-Reporting

Complaint

1.4. Additional Compliance Information

None

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	N/A	N/A	The Generator Owner <u>that has frequency protection activated to trip a generator has no documented and communicated technical limitation per Requirement R3 and</u> failed to set <u>its generator</u> frequency protective relaying so that it does not trip within the criteria listed in Requirement R1, <u>Parts 1.1 through 1.5.</u>
R2	N/A	N/A	N/A	The Generator Owner with voltage protective relaying <u>has no documented and communicated technical limitation per Requirement R3 and</u> failed to set its <u>voltage</u> protective relaying <u>so that it does not</u> trip as a result of a voltage excursion at the point of interconnection, caused by an event external to the plant per the <u>operating conditions and relay settings</u> specified in Requirement R2
R3	The Generator Owner documented the non-protection system equipment limitation that <u>prevents compliance with</u> prevented it from meeting	The Generator Owner documented the non-protection system equipment limitation that <u>prevents compliance with</u> prevented it from meeting	The Generator Owner documented the non-protection system equipment limitation that <u>prevents compliance with</u> prevented it from meeting	The Generator Owner failed to document any non-protection system equipment limitation that <u>prevents compliance with</u> prevented it from meeting

Draft 23

Date: ~~June 15, 2011~~ February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<u>the criteria in</u> Requirement R1 or R2 and communicated the documented limitation to its Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner more than 30 calendar days but less than or equal to 40 calendar days of identifying the limitation.	<u>the criteria in</u> Requirement R1 or R2 and communicated the documented limitation to its Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner more than 40 calendar days but less than or equal to 50 calendar days of identifying the limitation.	<u>the criteria in h</u> Requirement R1 or R2 and communicated the documented limitation to its Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner more than 50 calendar days but less than or equal to 60 calendar days of identifying the limitation.	<u>the criteria in</u> Requirement R1 or R2. OR The Generator Owner failed to communicate the documented limitation to its Reliability Coordinator, Planning Coordinator, Transmission Operator and Transmission Planner within 61 calendar days of identifying the limitation.
R4	The Generator Owner provided a written response to an equipment limitation inquiry more than 90 calendar days but less than or equal to 100 calendar days of a written request.	The Generator Owner provided a written response to an equipment limitation inquiry more than 100 calendar days but less than or equal to 110 calendar days of a written request.	The Generator Owner provided a written response to an equipment limitation inquiry more than 110 calendar days but less than or equal to 120 calendar days of a written request.	The Generator Owner failed to provide a written response to an equipment limitation inquiry within 121 calendar days of a written request.
R5 <u>R4</u>	The Generator Owner provided an estimate of a unit's performance more than 30 calendar days but less than or equal to 40 calendar days of a written request.	The Generator Owner provided an estimate of a unit's performance more than 40 calendar days but less than or equal to 50 calendar days of a written request.	The Generator Owner provided an estimate of a unit's performance more than 50 calendar days but less than or equal to 60 calendar days of a written request.	The Generator Owner failed to provide an estimate of a unit's performance within 61 calendar days of a written request. OR

Draft ~~23~~

Date: ~~June 15, 2011~~February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
		<p>OR</p> <p>The Generator Owner failed to include documentation for one of the Parts specified in Requirement R5, Parts 5.1 through 5.3.</p>	<p>OR</p> <p>The Generator Owner failed to include documentation for twoone of the Parts specified in Requirement R5R4, Parts 5.1 through 5.3 and 4.2.</p>	<p>The Generator Owner failed to include any of the documentation specified in Requirement R5R4, Parts 5.1 through 5.3 and 4.2.</p>
R6 <u>R5</u>	N/A	N/A	N/A	<p>The Generator Owner failed to demonstrate its new unit or new generating plant or generating Facility did not trip Owner's generator tripped due to a Frequency Excursion within the no-trip parameters set forth in Requirement 6, Attachment 1.</p> <p>OR</p> <p>The Generator Owner failed to demonstrate its new unit or new generating plant or generating Facility did not trip Owner's generator tripped due to a Voltage Excursion within the no-trip parameters set forth in Attachment 2.</p>
R7 <u>R6</u>	The Generator Owner provided its generator protection trip settings as specified by	The Generator Owner provide provided its generator protection trip settings as	The Generator Owner provide provided its generator protection trip settings as	The Generator Owner failed to provide its generator protection trip settings as specified by

Draft ~~23~~

Date: ~~June 15, 2011~~ February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<p>Requirements R1 and R2, and documented equipment limitations as specified by Requirement R3R6 more than 30 calendar days but less than or equal to 40 calendar days of any change to those trip settings or limitations.</p> <p>OR</p> <p>The Generator Owner provided trip settings or equipment limitations more than 30 calendar days but less than or equal to 40 calendar days of a written request.</p>	<p>specified by Requirements R1 and R2, and documented equipment limitations as specified by Requirement R3R6 more than 40 calendar days but less than or equal to 50 calendar days of any change to those trip settings or limitations.</p> <p>OR</p> <p>The Generator Owner provided trip settings or equipment limitations more than 40 calendar days but less than or equal to 50 calendar days of a written request.</p>	<p>specified by Requirements R1 and R2, and documented equipment limitations as specified by Requirement R3R6 more than 50 calendar days but less than or equal to 60 calendar days of any change to those trip settings or limitations.</p> <p>OR</p> <p>The Generator Owner provided trip settings or equipment limitations more than 50 calendar days but less than or equal to 60 calendar days of a written request.</p>	<p>Requirements R1 and R2, and documented equipment limitations as specified by Requirement R3R6 within 6460 calendar days of any change to those trip settings or limitations.</p> <p>OR</p> <p>The Generator Owner failed to provide trip settings or equipment limitations within 6460 calendar days of a written request for the data.</p>

E. Regional Variances

None

F. Associated Documents

None

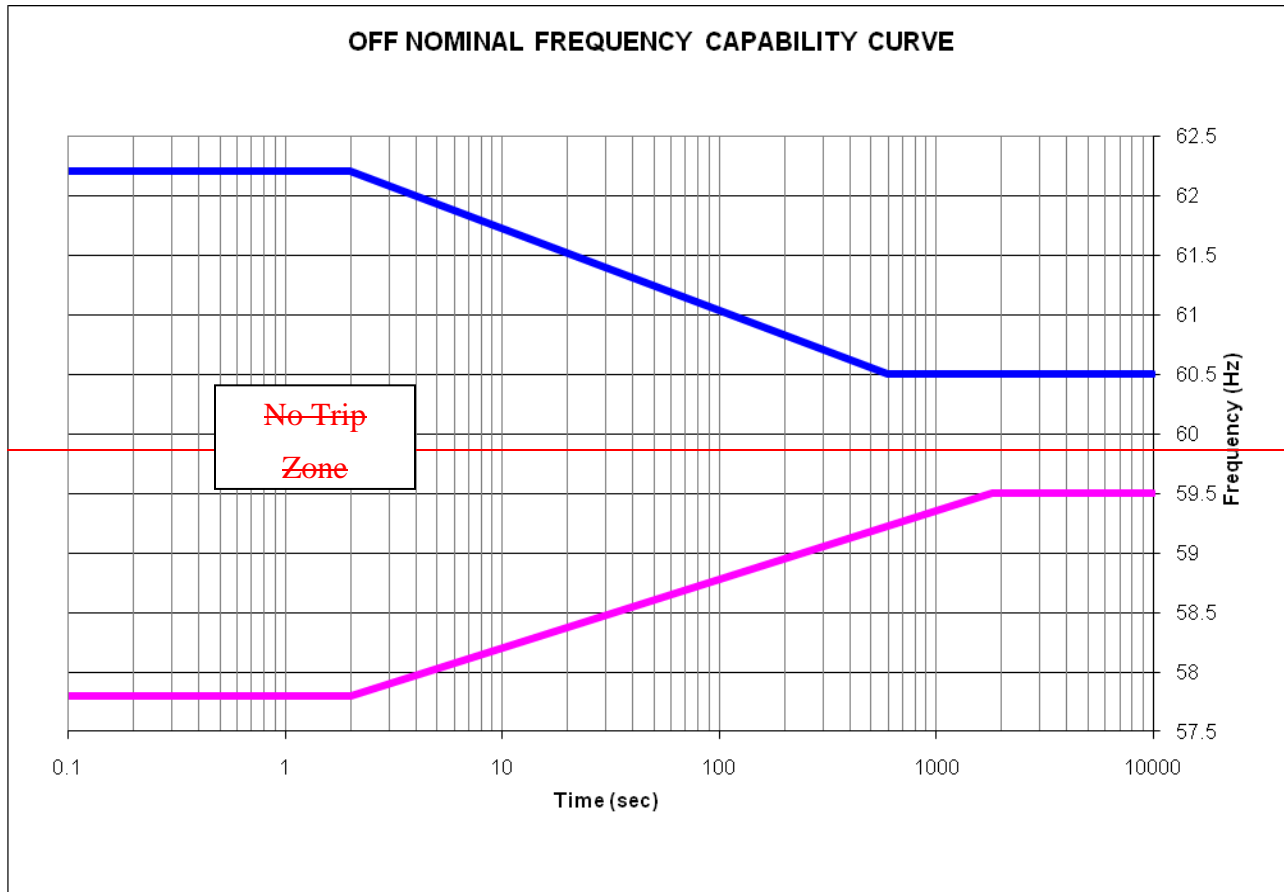
Version History

Version	Date	Action	Change Tracking

G. References

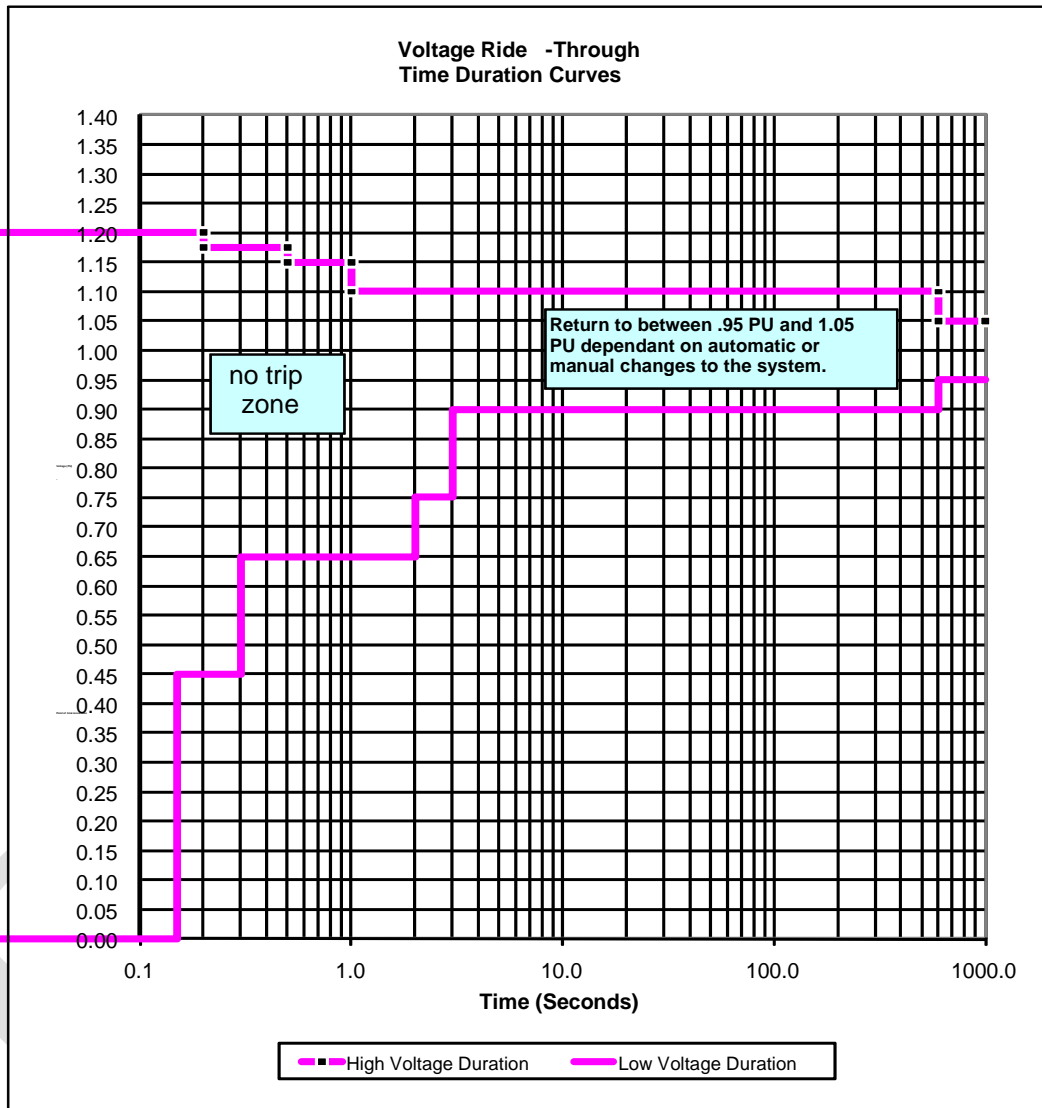
1. “The Technical Justification for the New WECC Voltage Ride-Through (VRT) Standard, A White Paper Developed by the Wind Generation Task Force (WGTF),” dated June 13, 2007, a guideline approved by WECC Technical Studies Subcommittee.

PRC-024 — Attachment 1



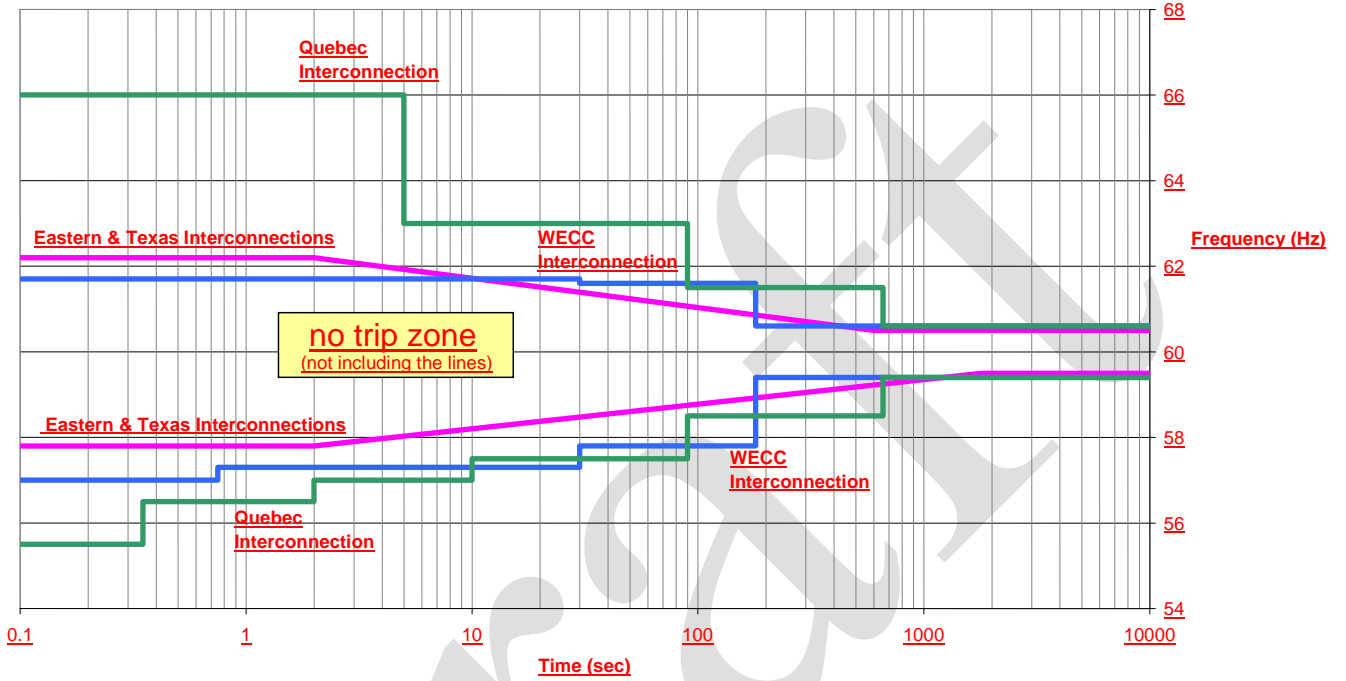
Frequency (hertz)	57.8	59.5	62.2	60.5
Time (seconds)	0 to 2	Over 1800	0 to 2	Over 600

PRC-024 Attachment 2



Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

OFF NOMINAL FREQUENCY CAPABILITY CURVE



Curve Data Points:

Draft 23

Date: ~~June 15, 2011~~ February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

Eastern and Texas Interconnections

<u>HVRT-DURATION</u> <u>High Frequency Duration</u>		<u>Low Frequency Duration</u>	
<u>Time (Sec)</u>	<u>Voltage (p.u.)</u> <u>Frequency (Hz)</u>	<u>Time (Sec)</u>	<u>Frequency (Hz)</u>
0.20-	1.200		
0.50-	1.175		
1.00-	1.150		
600	1.100		
<u>LVRT-DURATION</u>			
<u>Time (Sec)</u>	<u>Voltage (p.u.)</u>		
0.15 - 2	62.2	0.000 - 2	57.8
2 - 600	$62.41 - 0.30686\log(t)$	2 - 1800	$57.63 + 0.450575\log(t)$
2.00	0.650		
3.00	0.750		
≥ 600	0.90060.5	≥ 1800	59.5

Draft 23

Date: ~~June 15, 2011~~ February 22, 2012

Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

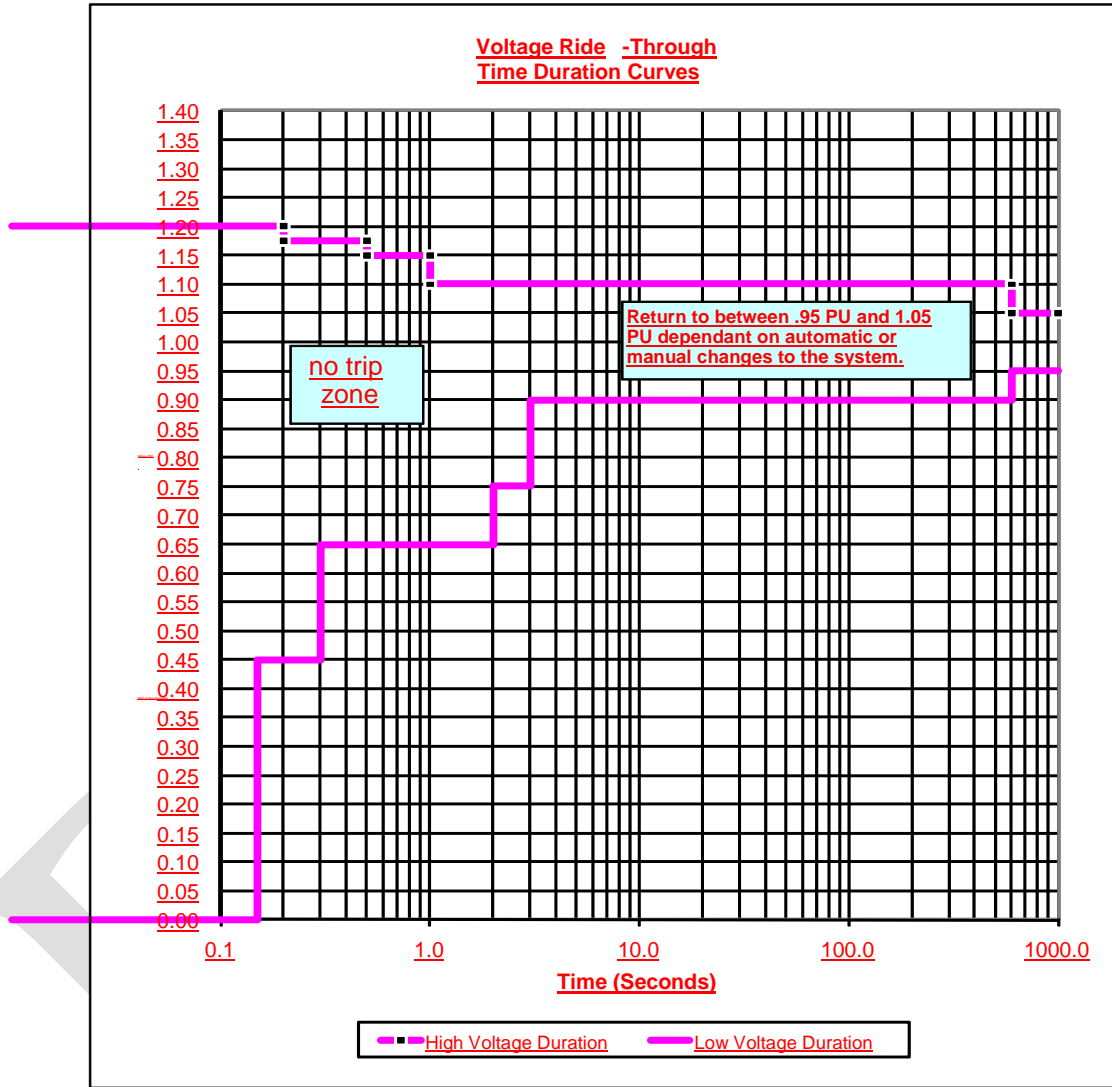
WECC Interconnection

<u>High Frequency Duration</u>		<u>Low Frequency Duration</u>	
<u>Time (Sec)</u>	<u>Frequency (Hz)</u>	<u>Time (Sec)</u>	<u>Frequency (Hz)</u>
<u>0 – 30</u>	<u>61.7</u>	<u>0 – 0.75</u>	<u>57.0</u>
<u>30 – 180</u>	<u>61.6</u>	<u>0.75 – 30</u>	<u>57.3</u>
<u>> 180</u>	<u>60.6</u>	<u>30 – 180</u>	<u>57.8</u>
		<u>> 180</u>	<u>59.4</u>

Quebec Interconnection

<u>High Frequency Duration</u>		<u>Low Frequency Duration</u>	
<u>Time (Sec)</u>	<u>Frequency (Hz)</u>	<u>Time (Sec)</u>	<u>Frequency (Hz)</u>
<u>0 – 5</u>	<u>66.0</u>	<u>0 – 0.35</u>	<u>55.5</u>
<u>5 – 90</u>	<u>63.0</u>	<u>0.35 – 2</u>	<u>56.5</u>
<u>90 – 660</u>	<u>61.5</u>	<u>2 – 10</u>	<u>57.0</u>
<u>> 660</u>	<u>60.6</u>	<u>10 – 90</u>	<u>57.5</u>
		<u>90 – 660</u>	<u>61.5</u>
		<u>> 660</u>	<u>60.6</u>

PRC-024— Attachment 2



Standard PRC-024-1 — Generator Performance During Frequency and Voltage Excursions

Curve Data Points:

<u>High Voltage Ride Through Duration</u>		<u>Low Voltage Ride Through Duration</u>	
<u>Time (Sec)</u>	<u>Voltage (p.u.)</u>	<u>Time (Sec)</u>	<u>Voltage (p.u.)</u>
<u>0.20</u>	<u>1.200</u>	<u>0.15</u>	<u>0.000</u>
<u>0.50</u>	<u>1.175</u>	<u>0.30</u>	<u>0.450</u>
<u>1.00</u>	<u>1.150</u>	<u>2.00</u>	<u>0.650</u>
<u>600</u>	<u>1.100</u>	<u>3.00</u>	<u>0.750</u>
		<u>600</u>	<u>0.900</u>

Draft 23

Date: ~~June 15, 2011~~ February 22, 2012

Voltage Ride-Through Curve Clarifications

Curve Details:

1. The per unit voltage base for these curves is the ~~scheduled operating~~base voltage ~~as measured~~specified in the system models used by the Transmission Planner in the analysis of the reliability of the Interconnected Transmission Systems at the point of interconnection to the Bulk Electric System (BES).
2. The curves depicted ~~apply to a~~were derived based on three-phase transmission system zone 1 ~~fault~~faults with Normal Clearing ~~not exceeding 9 cycles~~.
3. ~~When~~The envelope within the curves represents the cumulative voltage duration at the point of interconnection with the BES ~~is within~~. For example, if the voltage ~~boundaries of these curves, the generator exceeds 1.15 pu at 0.3 seconds after a fault, does not exceed 1.2 pu~~ protective relaying will not, and returns below 1.15 pu at 0.4 seconds, then the cumulative time the voltage is above 1.15 pu voltage is 0.1 seconds and is within the ~~no~~ trip zone of the generator ~~curve~~.
4. The curves depicted assume system frequency is 60 Hertz. Adjust the magnitude of the high voltage curve in proportion to deviations of frequency below normal.
5. Voltages in the curve assume minimum fundamental frequency phase-to-ground or phase-to-phase voltage for the low voltage duration curve and maximum crest phase-to-ground or phase-to-phase voltage for the high voltage duration curve.

Evaluating Protective Relay Settings:

- ~~5.6.~~Use the following assumptions ~~if basing to evaluate~~ voltage protection relay setting calculations on the static case for steady state initial conditions:
 - a. All of the units connected to the same transformer are online and operating,
 - b. All of the units are at full nameplate real-power output.
 - c. Power factor is 0.95 lagging- (i.e. supplying reactive power to the system) as measured at the generator terminals.
 - ~~d. Scheduled voltage is measured at the point of interconnection.~~
- ~~6.7.~~Calculate~~Evaluate~~ voltage protection relay settings ~~to comply with these curves~~ assuming that ~~any~~ additional installed generating plant reactive support equipment (such as static VAR compensators, synchronous condensers, or capacitors) is available and operating normally.
- ~~7.8.~~Calculate~~Evaluate~~ voltage protection relay settings ~~to comply with these curves~~, accounting for the actual tap settings of transformers between the generator terminals and the point of interconnection.