

## Unofficial Comment Form for the First Draft of PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings (Project 2007-09)

Please **DO NOT** use this form. Please use the **electronic comment form** located at the link below to submit comments on the proposed first draft of the Generator Verification standard PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings. Comments must be submitted by **April 2, 2009**. If you have questions please contact Harry Tom at [harry.tom@nerc.net](mailto:harry.tom@nerc.net) or by telephone at (860) 550-4157.

<http://www.nerc.com/filez/standards/Generator-Verification-Project-2007-09.html>

### Background Information:

This comment form pertains to PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings. The Generator Verification Standard Drafting Team (Project 2007-09) is comprised of six standards, one of which is PRC-024-1. These standards were originally “Phase III & IV Planning Measures” that were translated into new or a proposed standard as part of the Phase III & IV Standard Drafting Team effort. Collectively they set forth requirements to:

- Ensure generator and generator ancillary equipment are accurately modeled.
- Generator Protective Relay systems are appropriately set to “ride through” voltage and frequency excursions and to coordinate with load shed programs.
- Establish a regular process of verifying actual generator performance capability through periodic testing.

Draft standards that were field tested in 2006–2007 and are to be finalized as part of this project are:

PRC-019 — Coordination of Generator Voltage Regulator Controls with Unit Capabilities and Protection

PRC-024 — Generator Frequency and Voltage Protective Relay Settings

MOD-026 — Verification of Models and Data for Generator Excitation System Functions

MOD-027 — Verification of Generator Unit Frequency Response

Standards to be revised as part of this project are:

MOD-024 — Verification of Generator Gross and Net Real Power Capability

MOD-025 — Verification of Generator Gross and Net Reactive Power Capability

PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings was developed with consideration to key issues stated in the SAR:

- Provide more details to the applicability section of the standard to identify any generators that should be exempt from compliance with the requirements in the standard

## Comment Form — First Draft of PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings

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- Replace the requirements assigned to the Regional Reliability Organization with a set of requirements that has more specificity and includes a set of ‘continent-wide’ criteria for verification that generators will remain connected during specified system frequency and voltage excursions
- Assign responsibility to the appropriate functional entities as a result of updates to the functional model and the replacement of the requirements assigned to the Regional Reliability Organization
- Add a requirement for the Transmission Owner and Generator Owner to coordinate protection systems
- Add a ‘violation risk factor’ and a ‘time horizon’ for each requirement
- Update all the compliance sections of the standard, including:
  - Update the compliance monitoring section to clarify that the regional entity will be the compliance monitor for the generator owner
  - Replace the ‘levels of non-compliance’ with ‘violation severity levels’

The SDT first considered the purpose of the standard as defined in the SAR, the verifiable and measurable quantities in PRC-024-1 to ensure that the generators would stay connected are the relay settings in the generator protective relay schemes. The SDT has therefore proposed that standard PRC-024-1 be based on generator relay setting and coordination requirements, such as the time durations associated with various levels of voltage or frequency excursions.

For frequency excursions, this would include turbine under frequency protection relays. It was assumed by the SDT that excitation controls and limiters are set such that generator protective relays that are implemented to protect against excessive rotor field and stator over currents would not trip the unit as a result of the proposed frequency excursion.

For voltage excursions, only generator under or over voltage protective relays and volts per hertz relays would need to be evaluated to meet the draft requirements. Steady state evaluations only are expected. As such, dynamic simulations are not necessary to meet the requirements of the draft standard. The assessment of other generator protective relays that would require dynamic simulation to assess if they could ride through the proposed voltage excursion, such as generator backup over current or impedance, loss of field, are not within the scope of this draft standard.

In addition, the requirements are focused on the time immediately after a fault but before upsets to the auxiliary equipment could potentially cause the generator to trip.

The SDT next considered the “applicability”. Although the Generator Operator is the entity that can obtain the verified values of the relay settings, the Generator Owner is responsible for such settings.

In developing the proposed requirements, the SDT has reviewed the requirements of Regional Entities associated with potential voltage and frequency excursions, as well as simulated system responses to faults cleared with zone 1 and zone 2 distance relays. Understanding that some existing older generators were designed and constructed based on the then existing standards and may not be able to conform to the proposed new requirements, the SDT proposed that such limitations of existing generators be communicated to the Reliability Coordinators, Planning Coordinators, Transmission Operators and Transmission Planners that monitor or model the associated unit so that they

## **Comment Form — First Draft of PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings**

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be accounted for in the simulations of system responses. However, the generator will be required to conform to the standard if limitations are removed, for example, through equipment upgrades.

The following questions will assist the SDT in finalizing the development of PRC-024-1 Generator Frequency and Voltage Protective Relay Settings. For questions where you agree with the SDT, please state that you agree and if available, please provide supporting documentation. If you disagree with the SDT, please explain why you disagree and provide data to support your position. To improve this first draft of PRC-024-1 Generator Frequency and Voltage Protective Relay Settings, the SDT would appreciate responses to as many of these questions as you can answer.

## Comment Form — First Draft of PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings

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1. The PRC-024-1 Standard is applicable to the Generator Owner as opposed to Generator Operator, do you agree? If not, please explain in the comment area.

Yes

No

Comments:

2. The SDT has established the Requirements in this Standard only for the setting of voltage and frequency generator protective relays. Do you agree? If not, please explain in the comment area.

Yes

No

Comments:

3. PRC-024-1 specifies the limits for generator protective system settings as defined in PRC-024-1 - Attachment 1 and PRC-024-1 - Attachment 2. Are there generating units in your fleet that are not capable of meeting the thresholds in these attachments due to turbine/generator equipment design limitations?

Yes

No

Comments: The MRO does not own any generation.

If yes, please estimate the percentage and total MW capacity of your units that cannot meet the requirement.

Estimated percentage of units that can't meet thresholds due to design limitations:

Estimated total MW capacity of units that cannot meet the requirement:

4. The curve in PRC-024-1 - Attachment 2 was based upon analysis performed of simulated system disturbances. System voltage traces representative of several hundred disturbances were co-plotted on a voltage versus time graph. The voltage duration curve in this attachment is derived from these voltage traces. A margin was then applied to the voltage duration curve to account for unanticipated system conditions. The 9 cycle fault clearing time required by the FERC 661-A Order is incorporated into this curve. Given this background on the development of PRC-024-1 - Attachment 2, do you agree with the parameters of the curve? If not, please explain in the comment area.

Yes

No

Comments: Where would be the appropriate voltage measurement point? (Generator bus or POI)

5. Coordination between UFLS programs and generator frequency tripping is especially a concern in islanded situations. Is the connection voltage of  $\geq 100\text{kV}$ , the size threshold for generator units 20 MVA and greater and 75 MVA for multiple units at a single site, sufficient to address this concern? If not, please explain in the comment area.

## Comment Form — First Draft of PRC-024-1 — Generator Frequency and Voltage Protective Relay Settings

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Yes

No

Comments:

6. The SDT proposed a set of VRFs based on size delineation of units. Do you agree with this approach? Do you agree with the MVA levels? If you disagree with either the approach or the MVA levels, please explain in the comment area.

Yes I agree with the approach

No I disagree with the approach

Comments:

Do you agree with the MVA levels?

Yes

No

Comments:

7. If you are aware of any regional variances that would be required as a result of this standard please identify the regional variance here.

Regional Variance: If a region has performed a detailed system study of the Under Frequency protection systems in their region and developed protective settings based off the characteristics developed in the study, the region should be allowed to deviate from the Generator Protection curve in Attachment 1.

8. If you aware of any conflicts between the proposed standard and any regulatory function, rule order, tariff, rate schedule, legislative requirement or agreement, please identify the conflict here.

Conflict: No known conflict at this time.

9. Are there other improvements that the SDT should consider for this revision of PRC-024-1 that you haven't already identified in response to other questions? If yes, please provide in the comment area.

Yes

No

Comments: It would be good to have the option of measuring the voltage at the Generator bus or POI. With the understanding that the voltage must be maintained of the POI.