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In accordance with the NPCC Directory Development and Revision Manual NPCC Directory #9 *Verification of Real Power Capability* and Directory #10 *Verification of Reactive Power Capability* have been retired effective July 1, 2019.

The NPCC Full Member Committee approved the retirements on August 3rd, 2017 to coincide with the completion of the MOD-25-2 Implementation Plan.

NPCC Directories #9 and #10 are posted on the NPCC website with a 'retired' watermark.



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**NPCC
Regional Reliability Reference Directory # 10
Verification of Generator
Gross and Net Reactive Power Capability**

Task Force on Coordination of Operations Revision Review Record:
December 22, 2008
December 28, 2011

Adopted by the Members of the Northeast Power Coordinating Council, Inc. this December 22, 2008 based on recommendation by the Reliability Coordinating Committee, in accordance with Section VIII of the NPCC Amended and Restated Bylaws dated July 24, 2007 as amended to date.

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Version History

Version	Date	Action	Change Tracking (New, Errata or Revisions)
0	12/22/2008		New
1	07/07/2009	Included FAC-008 in Section 3.0	Errata
2	12/28/2011	Phase 2 format	Revisions
3	3/31/2015	Inserted Applicability of NPCC Criteria	New
4	7/01/2019	Retired	

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Terms Defined in the Directory

There are no new terms defined in this Revision. The definitions of terms found in this Directory appearing in bold typeface, can be found in the NPCC *Glossary of Terms*.

A. Introduction

1. **Title:** Verification of Generator Gross and Net Reactive Power Capability

2. **Directory #:** 10

3. **Objective:**

This Directory presents the minimum criteria requirements for verifying the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of generators or generating facilities.

Compliance to the criteria requirements set forth in this Directory by each applicable entity assures accuracy of information used in the steady-state models to assess the reliability of the NPCC bulk power system.

This Directory has been developed to ensure that the requirements specified in NERC Standard MOD-025-1, "Verification of Generator Gross and Net Reactive Power Capability" are met by NPCC and its applicable members responsible for meeting the NERC Reliability Standards.

4. **Effective Date:** December 22, 2008

5. **Background:**

This Directory was developed from the draft NPCC A-14 Verification of Generator Gross and Net Reactive Power Capability Criteria document whose technical content was approved by the Reliability Coordinating Committee on March 5, 2008 for conversion into a Directory. Version 0 of the Directory became effective on December 22, 2008.

6. **Applicability:**

The requirements of an NPCC Directory apply only to those facilities defined as NPCC **bulk power system** elements as identified through the performance based methodology of NPCC Document A-10, "Classification of Bulk Power System Elements," the list of which is maintained by the NPCC Task Force on System Studies and approved by the NPCC Reliability Coordinating Committee.

Requirements to abide by an NPCC Directory may also reside in external tariff requirements, bilateral contracts and other agreements between facility owners and/or operators and their assigned Reliability Coordinator, Planning Coordinator, Transmission Operator, Balancing Authority and/or Transmission Owner as applicable and may be enforceable through those external tariff requirements, bilateral contracts and other agreements. NPCC will not enforce compliance to the NPCC Directory requirements in this document on any entity that is not an NPCC Full Member.

6.1 Functional Entities (Responsible Entities)

- Generator Owners
- Transmission Operators (in whose area the generator or generation facility resides)

B. NERC ERO Reliability Standard Requirements

The NERC ERO Reliability Standards containing requirements that are associated with this Directory include, but may not be limited to:

- [MOD-025-1](#) - Verification of Generator Gross and Net Reactive Power Capability
- [TOP-002-2](#) - Normal Operations Planning
- [FAC-008-1](#) - Facility Ratings Methodology
- [FAC-009-1](#) - Establish and Communicate Facility Ratings

C. NPCC Regional Reliability Standard Requirements

None.

D. NPCC “Full Member” More Stringent Criteria Requirements

1. Requirements

1.1 Developing the List of Generators or Generation Facilities to be Verified

- R1. Transmission Operators shall develop and maintain documentation of those generators or generation facilities that must verify the **Gross Reactive Power Capability** and **Net Reactive Power Capability** for the summer and winter capability seasons. The documentation maintained by the Transmission Operator shall include the following:
- R1.1 All generators or generation facilities **Declared Gross Reactive Power Capability** and **Declared Net Reactive Power Capability** and seasonal auxiliary load reactive power requirements. (Reference Appendix B).
 - R1.2 All generators or generation facilities **Verified Gross Reactive Power Capability** and **Verified Net Reactive Power Capability**, verification date and method of verification.
 - R1.3 Discrepancies between a Generator Owner's declared and verified **Gross Reactive Power Capability** and **Net Reactive Power Capability**, the reason for such discrepancies and the Generator Owner's plan to address the discrepancies.
 - R1.4 Generator Owner supplied **Gross Reactive Power Capability** and **Net Reactive Power Capability** testing, manufacturer data, performance tracking or operating historical data, certification documentation, as specified by the Transmission Operator.
 - R1.5. Generators or generation facilities exempted from the verification requirements and the basis for their exemption (see Section 1.5).
- 1.2 Establishing the Generator Reactive Power Capability Verification Program
- R2. The Transmission Operator shall establish and document a program to periodically verify the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of all generators and generation facilities that are subject to periodic seasonal **Gross Reactive Power Capability** and **Net Reactive Power Capability** verification.
- R3. The Transmission Operator shall provide any changes to its verification process to the Generator Owners within 30 calendar days of issue.
- R4. The Transmission Operator shall establish and document requirements for a Generator Owner to notify the Transmission Operator within a specified time period when its generator or generation facility cannot achieve the **Declared Gross Reactive Power Capability** or **Declared Net Reactive Power Capability** because of equipment issues.

- R5. The Transmission Operator shall establish and document a time frame for the Generator Owner to address equipment issues that result in a generator or generation facility not achieving the **Declared Gross Reactive Power Capability** and **Declared Net Reactive Power Capability**.
- R6. The Transmission Operator shall establish and document the real power level at which the verification shall be performed, recognizing that the verification of lagging and leading reactive power capabilities should normally be performed during on-peak and off-peak hours, respectively.
- R7. The Transmission Operator shall establish and document those intermittent or small generating units whose capability may be represented by verification results of a single generating unit.
- 1.3 Implementing the Generator Reactive Power Capability Verification Program
- R8. The Transmission Operator shall request Generator Owners to verify the seasonal **Gross Reactive Power Capability** and **Net Reactive Power Capability** of their generators or generation facilities that are subject to periodic seasonal **Gross Reactive Power Capability** and **Net Reactive Power Capability** verification every five (5) years or more frequently as required by the Transmission Operator. The two (2) capability seasons are defined as summer and winter as specified by the Transmission Operator.
- R9. If a Transmission Operator determines that only one seasonal generating capability value is required for NPCC Bulk Power System reliability analysis, then periodic verification will be required only for that particular season.
- R10. If a Transmission Operator determines that the difference between the **Declared Gross Reactive Power Capability** and the **Declared Net Reactive Power Capability** of a generator or generation facility is insignificant for NPCC Bulk Power System reliability analysis, then periodic verification will be required for only one numerical value.
- R11. If a Transmission Operator determines that only the lagging or leading **Gross Reactive Power Capability** and **Net Reactive Power Capability** of a generator or generation facility is required for NPCC Bulk Power System reliability analysis, then periodic verification will be required only for that specific reactive power capability value.

- R12. The Generator Owner shall provide generator or generation facility **Declared Gross Reactive Power Capability** and **Declared Net Reactive Power Capability** to the Transmission Operator.
- R13. The Generator Owner shall provide evidence, upon request, to the Transmission Operator that the generator or generation facility **Gross Reactive Power Capability** and **Net Reactive Power Capability** have been verified.
- R14. The Generator Owner shall report to the Transmission Operator any discrepancies between Declared and Verified **Gross Reactive Power Capability** and **Net Reactive Power Capability** within a time frame specified by the Transmission Operator and develop and implement a plan to resolve the discrepancies.
- R15. The Generator Owner shall determine and report to the Transmission Operator the generator or generation facility reactive power seasonal auxiliary loads (including common station loads).
- 1.4 Verification Criteria for Generator and Generation Facility Reactive Power Capability
- R16. The Generator Owner shall comply with Transmission Operator requests for periodic verification of **Gross Reactive Power Capability** and **Net Reactive Power Capability** of their generators or generation facilities.
- R17. The Generator Owner shall verify the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of their generators or generation facilities according to their types. As specified by the Transmission Operator, the verification shall include any of the following:
- Testing,
 - Use of operating historical data,
 - Commissioning data (for new generators only),
 - Performance tracking data acquired during the same seasonal capability period.
- R18. The Generator Owner shall verify the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of Thermal Generators, Internal Combustion Generators, Gas Turbine Generators, Combined Cycle and Hydro Generators or generators operated as a synchronous condenser on the average leading reactive power output for at least a 15 consecutive minute period and average lagging reactive power output for at least a 60 consecutive minute period.
- R19. The Generator Owner shall verify the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of Intermittent power resources

(wind, tidal or geo-thermal generators) on performance tracking data. Manufacturers' data or commissioning data can be used until sufficient performance tracking data is available to verify generator or generation facilities lagging and leading reactive capabilities.

R20. The Generator Owner shall verify the **Gross Reactive Power Capability and Net Reactive Power Capability** for multiple generator facilities when limited by common elements on the reactive power capability of the facility and not the sum of the capabilities of the individual generators.

R21. The Generator Owner shall identify any equipment or other factor that will limit the capability of the generator or generation facility to meet its **Declared Gross Reactive Power Capability** or **Declared Net Reactive Power Capability**.

1.5 Exemption of Generators or Generation Facilities from Seasonal Verification Testing

R22. The Generator Owner shall notify the Transmission Operator and request an exemption if it cannot conduct seasonal capability testing of a generator or generation facility for any of the reasons listed below.

- Adverse impact on transmission system reliability
- Potential damage to transmission system or generator equipment
- Environment conditions
- Governmental regulatory or operating license limitations
- An extended outage to the generator or generation facility

R23. The Transmission Operator shall, within 30 calendar days of receiving notification from a Generator Owner that it is requesting an exemption because it cannot perform verification for the required seasonal period, notify the Generator Owner whether its generator will be exempted from the seasonal capability testing. Where the exemption is approved, the Transmission Operator shall coordinate with the Generator Owner to reschedule the verification for the next seasonal verification period.

R24. The Generator Owner for a generator or generation facility exempted from seasonal capability testing shall submit the following to the Transmission Operator:

- For existing generators, generator operation records, manufacturer data, or performance tracking for the previous applicable seasonal verification period for this generator or generation facility.

- Engineering analysis in conjunction with performance tracking data to justify any difference between a generator's or generation facility's **declared capability** and previous applicable seasonal performance tracking data.
- For new generators only, commissioning data.

Retired, Effective July 1, 2019

E. Compliance

1. Compliance Monitoring Process

Compliance with the requirements set forth in this Directory will be in accordance with the NPCC Criteria Compliance and Enforcement Program. (CCEP).

Measures and corresponding Levels of Non Compliance for these requirements are contained within the compliance template associated with this Directory.

2. Data Retention

Responsible Entities shall keep evidence of compliance for a minimum of five years. A Responsible Entity found non-compliant shall keep information related to the non-compliance until found compliant.

Prepared by: Task Force on Coordination of Operation

Review and Approval: Revision to any portion of this Directory will be posted by the lead Task Force in the NPCC Open Process for a 45 day review and comment period. Upon satisfactorily addressing all the comments in this forum, the Directory document will be sent to the remaining Task Forces for their recommendation to seek RCC approval.

Upon approval of the RCC, this Directory will be sent to the Full Member Representatives for their final approval if sections pertaining to the Requirements and Criteria portion have been revised. All voting and approvals will be conducted according to the most current "NPCC. Bylaws" in effect at the time the ballots are cast.

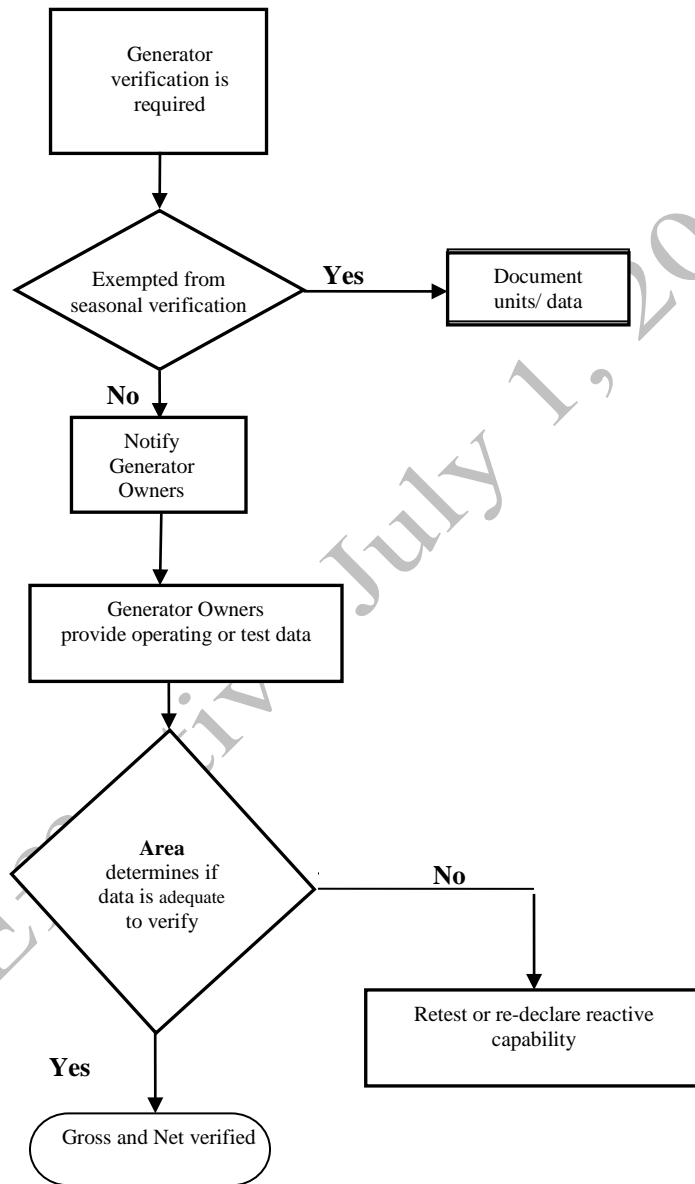
Revisions pertaining to the Appendices or any other portion of the document such as links, glossary terms, etc., only RCC Members will need to conduct the final approval ballot of the document.

This Directory will be updated at least once every three years and as often as necessary to keep it current and consistent with NERC, Regional Reliability Standards and other NPCC documents.

References: NPCC Glossary of Terms.

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Appendix A- Basic Flow Chart for Verification of Generator Gross and Net Reactive Power Capability



Appendix B - Generator Reactive Capability Form

GENERATOR REACTIVE CAPABILITY DATA FORM											
1. Data Preparation Documentation*											
Generator Facility Name		Unit No.		Facility ID			Generator Owner			Primary Contact	
Big Generator Station		1		12234			Big Power			Jim Smith	
Prepared By		Date prepared:		Effective Date			Contact Tel			Contact e-mail	
John Doe		01/05/2007		01/10/2007			XXX-XXX-XXXX			john@bigpower.com	
Auxiliary Reactive Power Requirements				Summer MVAR				Winter MVAR			
				20				15			
Reactive Data*											
Seasonal Data	Declared Real and Reactive Capability						Verified Reactive Capability and Season			Verification Method (T, P, C** as applicable)	Date Verified
	Summer			Winter			Winter				Date
	Gross MW	Gross MVAR	Net MVAR	Gross MW	Gross MVAR	Net MVAR	Gross MW	Gross MVAR	Net MVAR		
Lagging Capability	500	120	120	525	100	100	520	110	110	P	03/15/2007
Leading Capability	500	250	230	525	240	225	525	200 (1)	185(1)	T	01/25/2007
*Data inputted for illustration purposes, ** T- Testing; P- Performance Tracking; C-Commissioning data											
Notes and Limitations:		(1) Full MVAR capability could not be achieved because of system voltage restriction. Engineering analysis was provided to demonstrate unit was capable of declared values.									
Generating unit capability curve. Please attach a .jpg image from the generating unit capability D curve											