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# NPCC Task Force on Coordination of Operation (TFCO)

**Criteria Review and Comparison of**

**NPCC Directory#9---*Verification of Generator Gross and Net Real Power Capability***

**NPCC Directory#10---*Verification of Generator Gross and Net Reactive Power Capability***

**And**

**NERC Standard MOD -25-2 *Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability***

**And**

**TFCO Recommendation to Retire**

**Directory#9 and Directory#10**

**May 19th, 2016**

## Executive Summary

The Northeast Power Coordinating Council Inc. (NPCC) promotes the reliable and efficient operation of the interconnected Bulk Power System (BPS) in Northeastern North America by establishing regional reliability requirements for Operations, Planning and Bulk Power System protection.

Additionally, NPCC under the NERC Regional Delegation Agreement (RDA) must also adhere to the NERC Rules of Procedure (ROP).

In Appendix 2 of the ROP, NERC has defined Regional Criteria as "*...reliability requirements developed by a Regional Entity that are necessary to implement, to augment or to comply with Reliability Standards, but which are not Reliability Standards. Such Regional Criteria may be necessary to account for physical differences in the Bulk Power System but are not inconsistent with Reliability Standards nor do they result in lesser reliability. Such Regional Criteria are not enforceable pursuant to NERC delegated authorities, but may be enforced through other available mechanisms. Regional Criteria may include specific acceptable operating or planning parameters, guides, agreements, protocols or other documents.*"

Consequently NPCC must continually evaluate its regional reliability requirements to ensure that they continue to remain 'not inconsistent' with NERC Reliability Standards as those standards are developed or revised.

On March 20, 2014 FERC issued its Final Rule approving Reliability Standard MOD-25-2 *Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability* and a corresponding implementation plan along with three other verification standards developed or revised as part of Project 2007-09.

Accordingly, the NPCC Task Force on Coordination of Operation (TFCO) initiated a comprehensive comparison of NPCC Directory#9 *Verification of Generator Gross and Net Real Power Capability* and Directory#10 *Verification of Generator Gross and Net Reactive Capab*ility with the requirements of MOD-25-2 in order to assess the reliability impact of retiring all or part of the criteria contained within Directories #9 and #10.

This report includes a review of the reliability considerations surrounding NPCC's existing generator verification program as contained in Directories #9 and #10 and the impact of MOD-25-2 on that program, along with a recommendation by the TFCO and its CO7 Working Group on Operational Planning regarding the future disposition of the criteria in Directories #9 and #10.

## Background

NPCC Directories have been developed consistent with the NPCC Bylaws which provide for the establishment of regionally specific reliability criteria, guidelines and procedures; within each Directory NPCC's reliability criteria has been reviewed and translated to insure that the criteria is not inconsistent with the ERO standards as required by the NERC Rules of Procedure.

NPCC's existing regional criteria for the verification of real and reactive power capability of generators or generating facilities are contained in Directory #9 *Verification of Generator Gross and Net Real Power Capability* and Directory#10 *Verification of Generator Gross and Net Reactive Capab*ility and assures the accuracy of information in the steady state models used to assess the reliability of the NPCC Bulk Power System.

Directories #9 and #10 were originally developed and approved by the NPCC Full Members to ensure that the requirements of MOD-24-1 *Verification of Generator Gross and Net Real Power Capability* and MOD-25-1 *Verification of Generator Gross and Net Reactive Power Capability* were met by NPCC Members.

On March 16, 2007 FERC issued order No. 693, approving 83 of the 107 Reliability Standards filed by NERC; however since MOD-24-1 and MOD-25-1, which NERC had included in its filing, involved regional procedures that had not been submitted, the Commission postponed either approving or remanding these standards until NERC submitted additional information.

Subsequently, NERC Standards Project 2007-09 *Generator Verification* included the development of MOD-25-2 *Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability,* which merged MOD-24-1 and MOD-25-1 and also eliminated the regional reliability procedures (fill in the blank) contained in MOD-24-1 and MOD-25-1. Additionally, when MOD-25-2 received regulatory approval the Final Order also approved the retirement of MOD-24-1 and MOD-25-1 immediately prior to the effective date of MOD-25-2.

The verification criteria in Directories #9 and #10 rely on the Transmission Operator (TOP) to establish a Generator Verification Program both for Real and Reactive power. The TOP program includes the development of a list of generators or generation facilities to be verified, the implementation of the verification program, the establishment of verification criteria and the process for exempting generators or generation facilities from verification testing.

MOD-25-2 contains three Requirements and two Attachments and effectively replaces the existing NPCC verification program administered by the TOP by assigning applicability directly to Generator Owners and Transmission Owners that own synchronous condensers.

Attachment 1 of MOD-25-2, incorporated into Requirements R1.1, R2.1 and R3.1, specifies the periodicity for performing real and reactive power capability verification and the verification specifications for applicable facilities.

Attachment 2 of MOD-25-2, which Generator Owners and Transmission Owners will use to report to their Transmission Planners the information described in Attachment 1, is incorporated into Requirements R1.2, R2.2 and R3.2.

## Review of NPCC Criteria with MOD-25-2

In 2014 the NPCC Standards staff coordinated a preliminary comparison of the criteria contained in Directories #9 and #10 with the requirements in MOD-25-2 in order to determine whether or not it was feasible to retire Directories #9 and #10 upon the effective date of MOD-25-2.

A formal comparison of the criteria with the Standard's requirements was initiated by the NPCC Task Force on Coordination of Operation (TFCO) in 2015 when it assigned the CO7 Working Group on Operational Planning to consider the preliminary comparison and provide a formal recommendation to the TFCO on the question of whether or not the criteria within Directories #9 and #10 could be retired.

Although MOD-25-2 is subject to a 5 year implementation plan and will not be totally enforceable until 2019, the goal of the CO7 review was to consider the initial comparison and provide an assessment of any potential reliability gaps that may be created if Directories #9 and #10 were retired.

CO7 conducted its review through a series of WEBEX meetings and reviewed each of the NERC style criteria requirements in both Directories to consider whether or not individual criteria attributes could be retired.

### Directory#9--- *Verification of Generator Gross and Net Real Power Capability*

Directory#9 provides the minimum criteria requirements for verifying the **Gross Real Power Capability** and **Net Real Power Capability** of generators or generating facilities. Directory#9 was developed from the draft NPCC A-13 *Verification of Generator Gross and Net Real Power Capability* Criteria document whose technical content was approved by the Reliability Coordinating Committee (RCC) on March 5, 2008 for conversion into a Directory. Directory#9 was approved by the NPCC Full Member Committee on December 22, 2008.

Directory#9 relies on the Transmission Operator to develop a real power verification program which consists of compiling a list of generators or generation facilities to be verified, to implement the program in accordance with the Directory#9 verification criteria and to administer exemptions to the program. MOD-25-2 assigns applicability for verifying real power capability directly to the Generator Owner in accordance with the definition of the Bulk Power Electric System (BES) thereby replacing the role of the TOP in administering the overall verification program.

CO7 examined the specific attributes contained in the criteria and which comprise the existing TOP program in order to assess any potential reliability gaps that may be created upon the retirement of the criteria. The results of the CO7 review are provided below:

**Directory#9 Criteria Addressed in MOD-25-2 or Other NERC Standards:**

CO7 noted that certain existing criteria for generator real power verification contained in Directory#9 are found the requirements of MOD-25-2 or other NERC standards:

- **Notification to the TOP**---Directory#9 Criteria Requirement R4 which sets forth requirements for the GO to notify the TOP when its generator cannot achieve its capability is contained in TOP-002-2.1B Requirement R14 which obligates the GO to notify the TOP of changes in its real power capability.

- **Seasonal Testing**---Directory#9 Criteria Requirement R1 requires seasonal verification testing for the summer and winter capability seasons and MOD-25-2 does not require seasonal testing. However, TOP-002-2.1b Requirement R13 obligates a GO to perform real power testing at any time at the request of the TOP/BA.

  Additionally Directory#9 Criteria Requirement R9 currently permits exceptions to seasonal testing if it is determined that only one seasonal capability value is required for reliability assessments.

- **Correct Limitations to Real Power Capability**---Directory#9 Criteria Requirement R5 requires the GO to document a time frame for correcting equipment limitations impacting capability and MOD-25-2 does not have a similar requirement. However while TOP-002-2.1b does not explicitly obligate the GO to provide such a time frame it does obligate the GO to provide the TOP with a 7 day forecast of real power output (Requirement R15).

- **Limitation by a Common Element**---Directory#9 Criteria Requirement R21 limits the tested capability of generating units to the rating of the limiting facility and not the sum of the capabilities of the individual generators and MOD-25-2 does not address this operating condition. However, FAC-008-3 stipulates the requirement to limit a generators capability to observe constraints imposed by the connection facilities though not explicitly for multiple facilities.

**Directory#9 Criteria Less Stringent than MOD-25-2:**

CO7 noted that in some cases the MOD-25-2 requirements were more stringent than the criteria in Directory#9.

- **Declared vs. Verified Capability**----Directory#9 Criteria Requirement R13 obligates the GO to report discrepancies between declared and verified capability. The testing procedures in MOD-25-2 Requirement R1.1 (Attachment 1) and Requirement R1.2 (Attachment2) do not distinguish between declared and verified capability and only require the GO to report its verified capability. The absence of declared capability implies that the NERC standard is more stringent.

- **Testing Exemptions**---Directory#9 Criteria Requirements R23, R24 and R25 set forth conditions for testing exemptions. MOD-25-2 does not provide testing exemptions.

**Directory#9 More Stringent Criteria not addressed in MOD-25-2 (or Other NERC Standards):**

The CO7 review did reveal portions of the criteria in Directory#9 that were either more stringent or more specific than the requirements in MOD-25-2 and were not addressed in either MOD-25-2 or another NERC standard.

- **Frequency of Real Power Testing**---Directory#9 Criteria Requirement R8 obligates a real power capability test every 3 years while MOD-25-2 Requirement R1.1 (Attachment 1) requires real power capability verification every 5 years. Notwithstanding the more stringent frequency for real power testing in Directory #9, CO7 noted that the frequency of VAR testing in NPCC Directory #10 is aligned with the 5 year testing period in MOD -25-2.

- **Sustainability of Real Power Verification Testing**---Directory#9 Criteria Requirements R16, R17, R18 and R19 address the sustainability of real power testing for specific types of generation (thermal, gas turbines, hydro and combined cycle) and requires such testing to demonstrate sustainability for no less than one hour. MOD-25-2 does not address sustainability for verification testing by specific generation type but rather requires maximum real power testing for one hour on the general basis of synchronized generation. Therefore the Directory#9 criteria is more specific than MOD-25-2 although not necessarily more stringent.

**Directory#9 Conclusion:**

1. CO7 examined all of the criteria contained within Directory#9 and considered whether or not the criteria could be retired without creating any reliability gaps.

   CO7 agreed that the existing NPCC verification program which requires the TOP to administer real power testing procedures among the GO's in its local area could be retired since MOD-25-2 assigns applicability for real power verification directly to the GO.

   Additionally, most of the more stringent or more specific criteria found within Directory#9 are also addressed in the requirements of MOD-25-2 or another currently enforceable NERC standard.

   This includes the GO's obligation to notify the TOP when it cannot achieve its verified capability (TOP-002-2.1B) and the stipulation in FAC-008-3 to limit a generators capability to observe constraints imposed by the connection facilities.

   Some of the criteria attributes in Directory#9 were addressed indirectly in the NERC standards.

   For example, although the Directory#9 criteria for seasonal testing is not explicitly contained in either MOD-25-2 or another NERC standard, TOP-002-2.1b Requirement R13 obligates a GO to perform real power testing at any time upon the request of the TOP/BA.

   Likewise, while the Directory#9 criteria requiring the GO to document a time frame for correcting limitations impacting capability is also not addressed in the NERC standards, TOP-002-2.1b requires the GO to provide the TOP with a 7 day forecast of real power output.

2. CO7 noted that in some cases the MOD -25-2 requirements were more stringent than the criteria. MOD-25-2 requires only verified capability to be reported to its Transmission Planner and does not consider the Directory#9 criteria to identify and address differences between declared and verified capability. The absence of declared capability in the MOD standard implies that the standards requirements are more stringent. Also, the Directory#9 criteria permits testing exemptions under certain circumstances, whereas MOD-25-2 does not have such provisions.

3. Two criteria requirements in Directory#9 that are significantly more stringent than related MOD-25-2 requirements are:

   a. Criteria Requirement R8 which obligates real power testing every 3 years v. every 5 years in MOD-25-2.

b. Criteria Requirements R16, R17, R18 and R19 provide for real power verification for different types of generating units and stipulates a sustainability requirement for these capability tests (one hour) vs. the absence of any reference to specific generation types or a sustainability requirement in MOD-25-2.

Regarding item 3a) above CO7 observed that unlike the 3 year testing period for real power testing in Directory#9 , the 5 year testing period for reactive power testing in Directory#10 is already aligned with the 5 year period in MOD-25-2. Moreover, CO7 agreed that TOP-002-2.1b R13 obligates the GO to perform verification testing when requested by the TOP/BA.

For item 3b) above CO7 noted that the applicability sections (4.1 and 4.2) of MOD-25-2 address the obligation of various types of generation resources to comply with the standard based on MVA and not on generation type.

Additionally, MOD 25-2 Attachment #1 Section 2.1.2 does address variable generating units such as wind, solar and run of river.

CO7 acknowledges that the one hour sustainability requirement for testing specific types of generation resources in the criteria is more stringent than MOD25-2 which does not address this requirement other that a general obligation for synchronous generating units to perform maximum real and reactive testing for one hour in accordance with MOD 25-2 Attachment 1 Section 2.1.1.

However, CO7 notes that Areas are free to develop their own programs mandating more stringent sustainability requirements if necessary and enforceable via tariff or internal mechanisms.

## Directory#10---*Verification of Generator Gross and Net Reactive Power Capability*

Directory#10 provides the minimum criteria requirements for verifying the **Gross Reactive Power Capability** and **Net Reactive Power Capability** of generators or generating facilities. Directory#10 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 (RCC) on March 5, 2008 for conversion into a Directory. Directory#10 was approved by the NPCC Full Member Committee on December 22, 2008.

Directory#10 also relies on the Transmission Operator to develop an overall reactive power verification program which consists of compiling a list of generators or generation facilities to be verified, to implement the program in accordance with the Directory#10 verification criteria and to administer exemptions to the program. MOD-25-2 assigns applicability for verifying reactive power capability directly to the Generator Owner (or the Transmission Owner that owns synchronous condensers) in accordance with the definition of the Bulk Power Electric System (BES) thereby replacing the role of the TOP in administering the overall reactive power verification program.

CO7 examined the specific attributes contained in the criteria and which comprise the existing TOP program in order to assess any potential reliability gaps that may be created upon the retirement of the criteria. The results of the CO7 review are provided below:

**Directory#10 Criteria Addressed in MOD-25-2 or Other NERC Standards:**

CO7 noted that certain existing criteria for generator real power verification contained in Directory#10 are found the requirements of MOD-25-2 or other NERC standards:

- **Notification to the TOP**---Directory#10 Criteria Requirement R4 which sets forth requirements for the GO to notify the TOP when its generator cannot achieve its capability is also contained in TOP-002-2.1b Requirement R14 and which obligates the GO to notify the TOP of changes in its capabilities and characteristics. (although not explicitly for reactive power capability).

- **Seasonal Testing**---Directory#10 Criteria Requirement R1 requires seasonal verification testing for the summer and winter capability seasons and MOD-25-2 does not require seasonal testing. However, TOP-002-2.1b Requirement R13 obligates a GO to perform reactive power testing at any time at the request of the TOP/BA.

  Additionally Directory#10 Criteria Requirement R9 currently permits exceptions to seasonal testing if it is determined that only one seasonal capability value is required for reliability assessments.

- **Limitation by a Common Element**---Directory#10 Criteria Requirement R20 limits the tested capability of generating units to the rating of the limiting facility and not the sum of the capabilities of the individual generators and MOD-25-2 does not address this operating condition. However, FAC-008-3 stipulates the requirement to limit a generators capability to observe constraints imposed by the connection facilities though not explicitly for multiple facilities.

- **Real Power Output while Testing Reactive Capability** ---Directory #10 Criteria Requirement R6 sets forth requirements for real power output when testing leading and lagging VAR's. MOD-25-2 Requirement R2.2 (Attachment1) Section 2.2 obligates the GO to perform VAR testing at either maximum or minimum real power capability as applicable.

- **Frequency of Reactive Power Capability Testing:** --- Directory#10 Criteria Requirement R8 obligates reactive power capability testing every 5 years which is aligned with the frequency of reactive power testing in MOD-25-2.

**Directory#10 Criteria Less Stringent than MOD-25-2:**

CO7 noted that in some cases the MOD-25-2 requirements were more stringent than the criteria in Directory#10.

- **Declared vs. Verified Capability**----Directory#10 Criteria Requirement R14 obligates the GO to report discrepancies between declared and verified capability. The reactive power testing procedures in MOD-25-2 Requirement R2.1 (Attachment 1) and Requirement R2.2 (Attachment2) do not distinguish between declared and verified capability and only require the GO to report its verified capability. The absence of declared capability implies that the NERC standard is more stringent.

- **Testing Exemptions**---Directory#10 Criteria Requirements R22, R23 and R24 set forth conditions for testing exemptions. MOD-25-2 does not provide testing exemptions.

- **Verification of Variable Generating Units**---Directory#10 Criteria Requirements R19 provides flexibility when testing intermittent power resources (wind, solar). Specific verification requirements for variable resources are addressed in MOD-25-2, however there is no flexibility regarding the substitution of other documentation in the place of an actual test in MOD-25-2. Therefore MOD-25-2 is more stringent than the criteria in Directory#10.

**Directory#10 More Stringent Criteria not addressed in MOD-25-2 (or Other NERC Standards):**

The CO7 review did reveal portions of the criteria in Directory#10 that were either more stringent or more specific than the requirements in MOD-25-2 and were not addressed in either MOD-25-2 or another NERC standard.

- **Sustainability of Reactive Power Verification Testing**---Directory#10 Criteria Requirement R18 sets forth sustainability requirements for leading and lagging reactive power testing. R18 stipulates leading reactive power output for 15 consecutive minutes and lagging reactive power output for at least 60 consecutive minutes. MOD-25-2 does not require sustainability for VAR testing therefore the criteria in Directory#10 is more stringent in this regard.

- **Correct Limitations to Real Power Capability**---Directory#10 Criteria Requirement R5 requires the GO to document a time frame for correcting equipment limitations impacting reactive power capability and MOD-25-2 does not have a similar requirement. Although TOP-002-2.1b does obligate the GO to provide the TOP with a 7 day forecast of real power output (Requirement R15) there is no comparable notification for reactive power capability and therefore the criteria in Directory#10 is more stringent.

**Directory#10 Conclusion:**

1. Similar to Directory#9, CO7 examined all of the criteria contained within Directory#10 and considered whether or not the criteria could be retired without creating any reliability gaps.

   CO7 agreed that the existing NPCC verification program which requires the TOP to administer reactive power testing procedures among the GO's in its local area could be retired since MOD-25-2 assigns applicability for reactive power verification directly to the GO.

   As with Directory#9 most of the more stringent or more specific criteria found within Directory#10 are also addressed in the requirements of MOD-25-2 or another currently enforceable NERC standard.

   This includes the frequency of reactive power testing (every 5 years) which is aligned with the frequency of reactive power testing in MOD-25-2 and the obligation (criteria Requirement R20) to limit the tested capability of generating units to the rating of the limiting facility and not the sum of the capabilities of the individual generators which is stipulated in FAC-008-3.

   Some of the criteria attributes in Directory#10 are addressed indirectly in the NERC standards.

   For example, although the Directory#10 criteria for seasonal reactive power testing is not explicitly contained in either MOD-25-2 or another NERC standard, TOP-002-2.1b Requirement R13 obligates a GO to perform reactive power testing at any time upon the request of the TOP/BA.

2. CO7 noted that in some cases the MOD-25-2 requirements were more stringent than the criteria. MOD-25-2 requires only verified capability to be reported to its Transmission Planner and does not consider the Directory#10 criteria to identify and address differences between declared and verified capability. The absence of declared capability in the MOD standard implies that the standards requirements are more stringent. Also, the Directory#10 criteria permits testing exemptions under certain circumstances, whereas MOD-25-2 does not have such provisions, implying that the standard is also more stringent in this regard.

   Additionally, Directory#10 criteria Requirement R6 sets forth requirements for testing reactive power capability during on peak and off peak hours depending on the nature of the reactive power test (lagging or leading). However, MOD-25-2 Attachment 1 Section 2.2 is more specific than the criteria requiring reactive capability testing at the appropriate minimum or maximum real power output.

Finally, Directory#10 Criteria Requirement R19 provides flexibility when testing intermittent power resources (wind, solar) which is effectively covered by Section 2 in Attachment #1 of MOD-25-2 and which does not allow the use of manufacture's data or commissioning data as a substitution for an actual test.

3. Two criteria requirements in Directory#10 that are significantly more stringent than related MOD-25-2 requirements are:

    a. Criteria Requirement R18 which sets forth sustainability requirements for leading and lagging reactive capability testing. R18 stipulates leading reactive power output for 15 consecutive minutes and lagging reactive power output for at least 60 consecutive minutes vs. MOD-25-2 which does not require sustainability for reactive power testing.
    b. Criteria Requirement R5 which requires the GO to document a time frame for correcting equipment limitations impacting reactive power capability. Although TOP-002-2.1b does obligate the GO to provide the TOP with a 7 day forecast of real power output (Requirement R15), which allows the TOP to estimate real power capability during that forecasted period, there is no comparable notification requirement for reactive power capability in MOD-25-2 or other NERC standards.

Regarding item 3a) above, while acknowledging the absence of sustainability requirements for reactive power capability testing in MOD-25-2 , CO7 observed that other aspects of the MOD-25-2 testing procedures are more stringent than the standard. For example, CO7 noted that reactive power verification testing in the standard must be demonstrated on four separate points of the generators capability curve. Additionally, CO7 notes that Areas are free to develop their own programs mandating more stringent sustainability requirements if necessary and enforceable via tariff or internal mechanisms.

For item 3b) above CO7 again noted that Areas are free to develop their own programs mandating specific notification requirements if necessary and enforceable via tariff or internal mechanisms.

**TFCO Recommendation:**

The TFCO and the CO7 Working Group on Operational Planning have compared the criteria in NPCC Directories #9 and #10 with the requirements of MOD-25-2 and determined that there would be no significant reliability gaps if the criteria requirements in each of the Directories were retired.

TFCO recommends the following actions:

a. The regional criteria within Directories #9 and #10 containing the verification requirements for real and reactive power should be retired effective July 1st, 2019 to coincide with the completion of the MOD-25-2 Implementation Plan.
b. Directories #9 and #10 shall remain in force along with the existing TOP verification program until MOD-25-2 is fully enforceable.