

Standard Authorization Request Form

Title of Proposed Standard	Generator Verification (Project 2007-09)
Request Date	April 3, 2007
Modified Date	June 14, 2007

SAR Requestor Information	SAR Type <i>(Check a box for each one that applies.)</i>	
Name: Bob Millard	<input checked="" type="checkbox"/>	New Standards
Primary Contact: Bob Millard	<input checked="" type="checkbox"/>	Revision to existing Standards:
Telephone: (708) 588-9886 Fax:	<input type="checkbox"/>	Withdrawal of existing Standard
E-mail: bob.millard@rfirst.org	<input type="checkbox"/>	Urgent Action

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Purpose

The purpose of Project 2007-09 Generator Verification is:

- To ensure that generators will not trip off-line during specified voltage and frequency excursions or as a result of improper coordination between generator protective relays and generator voltage regulator controls and limit functions (such coordination will include the generating unit's capabilities).
- To ensure that generator models accurately reflect the generator's capabilities and operating characteristics.

New standards 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 Performance During Frequency and Voltage Excursions

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

Industry Need

All six of the standards included in this project address generator verifications needed to support bulk power system reliability. All six of the standards included in this project were originally "Phase III & IV Planning Measures" that were translated into new or proposed standards as part of the Version 0 translation effort. Stakeholders have already agreed that there is a reliability-related need for each of these standards as part of the work performed in association with the Phase III & IV Modeling SAR. In addition, each of the standards included in this project has some "fill-in-the-blank" requirements assigned to the Regional Reliability Organization that need to be replaced with more specific "continent-wide" requirements before the standards are approved.

Specifically:

- MOD-024-1 and MOD-025-1 were approved by the NERC Board of Trustees but are "pending" with FERC because they include "fill-in-the-blank" requirements assigned to the Regional Reliability Organization (MOD-024-1 and MOD-025-1 require generator owners to verify the generator's gross and net real and reactive power capability using an RRO established procedure).

- PRC-019-1, PRC-024-1, MOD-026-1 and MOD-027-1 are draft standards that were developed under the Phase III & IV Modeling SAR that have not been presented to the NERC Board of Trustees yet. These four standards contain "fill-in-the-blank" requirements assigned to the Regional Reliability Organization (RRO) which were appropriate when the standards were initially drafted but are not appropriate under current requirements for approval of enforceable standards. Work on these standards to remove the "fill-in-the-blank" requirements under the Phase III & IV Modeling SAR is not authorized and therefore cannot be completed under the Phase III & IV Modeling SAR because the modifications needed to make the standards enforceable are outside the scope of the original Phase III & IV SARs. To properly complete these standards, a new SAR is needed and the prior SAR need to be terminated (termination of the Phase III & IV Modeling SAR will be performed outside the work of this SAR).
 - This set of standards includes verification of the generator's excitation system; verification of the generator's frequency response; verification that the generator can remain connected during specified voltage and frequency excursions; and verification that the generator's voltage regulator controls and limit functions have been coordinated with the generator's capabilities and protective relays.
 - The field test for this set of standards has shown that a standard can be written to support these verifications.

Brief Description

The scope of this project includes:

- modifying the six standards associated with this project so they conform to the latest version of NERC's Reliability Standards Development Procedure and the ERO Rules of Procedure,
- replacing the "fill-in-the-blank" requirements assigned to the Regional Reliability Organization with requirements that can be applied on a continent-wide basis and are assigned to users, owners or operators of the bulk power system,
- considering and addressing issues identified in FERC orders, including the modifications to MOD-024-1 and MOD-025-1 as proposed in FERC Order 693, and
- considering and addressing issues identified during Phase III & IV field testing.

Detailed Description

The standards drafting team (SDT) will bring the six standards into conformance with the latest version of NERC's Reliability Standards Development Procedure and the ERO Rules of Procedure. In addition, the SDT will consider and address all applicable FERC Orders including but not limited to FERC Order 693, the field test results from the Phase III & IV field testing, issues raised by the industry during the posting of the SAR for Project 2007-09 Generator Verification identified in Attachment 1, and the following proposed changes for each of the six standards in this set of standards:

Draft PRC-019-1

- Revise the purpose statement to include the reliability-related benefit of the standard
- 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
- 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 generator voltage regulator controls and limit functions are coordinated with the generator's capabilities and protective relays
- 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 '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'

Draft PRC-024-1

- 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
- 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'

MOD-024-1:

- 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
- 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 of models and data associated with verification of generator gross and net real power capability
 - Consider requiring the generator owner to document the test conditions and

the relationships between test conditions and generator output

- 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 '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'

MOD-025-1:

- 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
- 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 of models and data associated with verification of generator gross and net Reactive Power capability
 - Consider requiring verification of reactive power capability at multiple points over a unit's operating range
- 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 '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'

Draft MOD-026-1

- 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
- 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 of models and data associated with generator excitation system functions
- 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 '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'

Draft MOD-027-1

- Revise the purpose statement to include the reliability-related benefit of the standard
- 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
- 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 of models and data associated with generator unit frequency response

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- 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 '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'

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Reliability Functions

The Standard Drafting Team will Consider Applicability to All Functional Entities <i>(Check box for each one that may apply.)</i>		
<input checked="" type="checkbox"/>	Reliability Coordinator	Responsible for the real-time operating reliability of its Reliability Coordinator Area in coordination with its neighboring Reliability Coordinator's wide area view.
<input type="checkbox"/>	Balancing Authority	Integrates resource plans ahead of time, and maintains load-interchange-resource balance within a Balancing Authority Area and supports Interconnection frequency in real time.
<input type="checkbox"/>	Interchange Coordinator	Ensures communication of interchange transactions for reliability evaluation purposes and coordinates implementation of valid and balanced interchange schedules between Balancing Authority Areas.
<input checked="" type="checkbox"/>	Planning Coordinator	Assesses the longer-term reliability of its Planning Coordinator Area.
<input type="checkbox"/>	Resource Planner	Develops a >one year plan for the resource adequacy of its specific loads within a Planning Coordinator area.
<input checked="" type="checkbox"/>	Transmission Planner	Develops a >one year plan for the reliability of the interconnected Bulk Electric System within its portion of the Planning Coordinator area.
<input type="checkbox"/>	Transmission Service Provider	Administers the transmission tariff and provides transmission services under applicable transmission service agreements (e.g., the pro forma tariff).
<input checked="" type="checkbox"/>	Transmission Owner	Owns and maintains transmission facilities.
<input checked="" type="checkbox"/>	Transmission Operator	Ensures the real-time operating reliability of the transmission assets within a Transmission Operator Area.
<input type="checkbox"/>	Distribution Provider	Delivers electrical energy to the End-use customer.
<input checked="" type="checkbox"/>	Generator Owner	Owns and maintains generation facilities.
<input checked="" type="checkbox"/>	Generator Operator	Operates generation unit(s) to provide real and reactive power.
<input type="checkbox"/>	Purchasing-Selling Entity	Purchases or sells energy, capacity, and necessary reliability-related services as required.
<input type="checkbox"/>	Market Operator	Interface point for reliability functions with commercial functions.
<input type="checkbox"/>	Load-Serving Entity	Secures energy and transmission service (and related reliability-related services) to serve the End-use Customer.

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Reliability and Market Interface Principles

Applicable Reliability Principles <i>(Check box for all that apply.)</i>	
<input checked="" type="checkbox"/>	1. Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
<input checked="" type="checkbox"/>	2. The frequency and voltage of interconnected bulk electric systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
<input checked="" type="checkbox"/>	3. Information necessary for the planning and operation of interconnected bulk electric systems shall be made available to those entities responsible for planning and operating the systems reliably.
<input type="checkbox"/>	4. Plans for emergency operation and system restoration of interconnected bulk electric systems shall be developed, coordinated, maintained and implemented.
<input type="checkbox"/>	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk electric systems.
<input type="checkbox"/>	6. Personnel responsible for planning and operating interconnected bulk electric systems shall be trained, qualified, and have the responsibility and authority to implement actions.
<input type="checkbox"/>	7. The security of the interconnected bulk electric systems shall be assessed, monitored and maintained on a wide area basis.
<input type="checkbox"/>	8. Bulk power systems shall be protected from malicious physical or cyber attacks.
Does the proposed Standard comply with all of the following Market Interface Principles? <i>(Select 'yes' or 'no' from the drop-down box.)</i>	
1. A Reliability Standard shall not give any market participant an unfair competitive advantage. Yes	
2. A Reliability Standard shall neither mandate nor prohibit any specific market structure. Yes	
3. A Reliability Standard shall not preclude market solutions to achieving compliance with that Standard. Yes	
4. A Reliability Standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. Yes	

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Related Standards

Standard No.	Explanation

Related SARs

SAR ID	Explanation
Phase III&IV Modeling	This SAR dated 11/17/04 initiated work on all six standards, two of which have been approved by the NERC BOT and four of which are still in draft phase, as referenced above above. The SDT working on the four draft standards will be terminated and undertaken by the new SDT for this SAR.

Regional Variances

Region	Explanation
ERCOT	
FRCC	
MRO	
NPCC	
SERC	
RFC	
SPP	
WECC	

Attachment 1

Issues Raised by Industry During 1st Posting of SAR for Project 2007-09 Generator Verification Which are Outside the Responsibility of the SAR Drafting Team

Question 2 of the Comment Form: *Two of the standards (MOD-024 and MOD-025) associated with this SAR had already been approved by the NERC Board of Trustees, but are “pending” with FERC because they include “fill-in-the-blank” requirements assigned to the Regional Reliability Organization. These standards must be revised to remove the fill-in-the-blank characteristics before they can become mandatory and enforceable. The intent of MOD-024 and MOD-025 is to ensure that accurate information on generator gross and net real and reactive power capability is available for the steady-state models used to assess bulk electric system reliability. To be enforceable, these standards need to be revised. Do you agree that there is a reliability-related need to revise these standards to support accurate modeling?*

Ameren commented:

With regards to the scope of MOD-025, it should not be necessary to include a blanket requirement for verification of reactive power capability at multiple points for all generators. However, should a generator frequently have difficulty reaching its stated reactive power output, additional testing requirements for that generator would be indicated.

FirstEnergy commented:

The present legacy document ECAR Document 4 details the testing and is sufficient to cover the present accuracy for a regional basis. The standards if spread to a national level will need to look at the difference between summer peaking regions and winter peaking. Presently the testing in RFC follows ECAR Document 4 which corrects the testing for average ambient conditions which is left up to the discretion of the testing personnel. The temperature conditions of the water inlet or ambient air needs to be defined.

Question 3 of the Comment Form: *The scope of this project includes:*

- *Modifying the six standards associated with this project so they conform to the latest version of NERC’s Reliability Standards Development Procedure and the ERO Sanction Guidelines,*
- *Replacing the fill-in-the-blank requirements assigned to the Regional Reliability Organization with requirements that can be applied on a continent-wide basis and are assigned to users, owners, or operators of the bulk power system, and*
- *Addressing issues identified in FERC Order 693.*

Do you agree with this scope? If not, please explain in the comment area.

IESO commented:

The SDT should consider the term characteristics during the review of the standards. The following is an example of: PRC-019-1
R2.1.2 & R2.1.5 - How to define characteristics? A common interpretation could be to define characteristics as the "setpoints" for the controllers. However, this does not appear to be the case as in other requirements they request "setpoints" as is shown in R2.1.6. MOD-026-1 appears to address this but refers to the excitation system functions.

In other words, the terms "characteristics" and "setpoints/settings" are presented in the requirements without clearly clarifying the meaning of the terms. "Characteristic" could mean something like a Generator capability curve (or any operating curve for that matter or nomograms) where the operations are defined by a "bounded region of operation" as such and is kind of "analog" in nature. "Setpoint/Setting" on the other hand could be something like a Generator Under-frequency trip setting where there are "set-points" for tripping – kind of "digital" in nature. Is this what the SDT means by these terms. Please clarify. As the standards are reviewed, there are specific questions that need to be addressed such as: MOD-025-1

R1.5.3 - Is this individual loads, or is this an overall value for the total auxiliary loads running at full station output?

Also, What will define the need to revisit this when equipment changes occur? In addition, the SDT should consider additional field tests for all the changes associated with the revised standard.

IRC-SRC and ISO-NE commented:

The SDT should consider the term characteristics during the review of the standards. Sections below are identified as locations for clarification.

-PRC-019-1

R2.1.2 & R2.1.5 - How to define characteristics? A common interpretation would be define characteristics as the "setpoints" for the controllers. However, this does not appear to be the case as in other requirements they request "setpoints" as is shown in R2.1.6. MOD-026-1 appears to address this but refers to the excitation system functions. What is meant by characteristics, if the characteristics are not defined as the setpoint? As the standards are reviewed, there are specific questions that need to be addressed such as:

MOD-025-1

R1.5.3 - Is this individual loads, or is this an overall value for the total auxiliary loads running at full station output?

Also, What will define the need to revisit this when equipment changes occur?

The SDT should also identify a date for compliance for each of the requirements and measures. Here are a few examples:

-MOD-024-1

M1 & M3 - Will need to prescribed a date for compliance

-MOD-026-1

M3 - Will need to prescribed a date for compliance

-MOD-027-1

M1 & M3 - Will need to prescribed a date for compliance

FirstEnergy commented:

The project should account for potential regional differences. See comment on question # 5 below.

Question 5 of the Comment Form: *If you are aware of any regional variances that will be needed as a result of this project, please identify the Regional Variance:*

FirstEnergy commented:

Not aware of existing, but potential for regional differences exist. The fill-in-the-blank needs to take into account regional differences such as summer or winter peaking conditions. The standard needs to address the main factor in generation capacity which is inlet water temperatures on once through cooling units and ambient temperature and humidity on cooling towers and combustion turbines.

Question 7 of the Comment Form: *If you have any other comments on this SAR that you haven't already mentioned above, please provide them here:*

AEP commented:

Please transmit to the Standard Drafting Team the following specific suggested revisions to MOD-025:

Key changes relate to FERC's requirement that regional "fill-in-the-blank" standards be rewritten as North American standards; these and other recommended changes are provided below:

A. Introduction

1. Title: Verification of Generator [] Reactive Power Capabilities
3. Purpose: To ensure that [] steady-state models used for assessing Bulk Electric System reliability reflect realistic/usable generator reactive power capabilities.

B. Requirements

R1. The North American Electric Reliability Corporation (NERC) shall establish and maintain procedures to address verification of generator gross and net Reactive Power capability. These procedures shall include the following:

R1.5. Information to be reported to Regional Reliability Organization (RRO):

R1.5.1. Verified maximum gross and net Reactive Power capability (both lagging and leading) at Seasonal Real Power generating capabilities as reported in accordance with Reliability Standard MOD-024 Requirement 1.5.1. and at Minimum Real Power output levels of generators. Net capabilities should be reported at the low- and high-voltage terminals of generator step-up (GSU) transformers.

R1.5.3. Verified Real and Reactive Power of auxiliary loads fed from: (a) generator bus and (b) transmission system bus (listed separately).

R1.5.5. System bus voltages (as scheduled and as verified), generator bus voltage and generator hydrogen pressure.

R1.5.6. In-service transformer taps setting and impedance (including base quantities).

R1.6. Requirement that sanity checks (or analysis) be used to ensure consistency/accuracy of reactive power capabilities obtained via measurement.

R2. The RRO shall provide [] generator gross and net Reactive Power capability verification and reporting procedures, and any changes to those procedures, to

...

R3. The Generator Owner shall follow NERC's procedures for verifying and reporting to RRO generator gross and net Reactive Power capabilities per R1.

C. Measures

M2. The RRO shall have written evidence that [] procedures...

M3. The Generator Owner shall have written evidence it provided verified information of its generator gross and net Reactive Power capabilities, consistent with NERC's procedures.

D. Compliance

This section should be revised to recognize that the procedures for generator Reactive Power capability verification will be written by NERC as a continent-wide standard. AEP recommends that Ape's Circular Letter OP-G-CL-011 (Reactive Capability Testing of Generators), developed over nearly two decades of testing experience and advocacy within the former ECAR region, be used as a reference in drafting this standard.

ATC LLC commented:

The SAR includes language requiring the SDT to identify any generators that should be exempt from compliance. There are many standards both under this project and others (such as Project 2007-01) that need to consider applicability based on generator size and/or voltage. If these standards remain separate, this requirement will either force

needless repetition of the same language in many standards, or there is a distinct possibility that differences will develop among the exemptions, making it very difficult for generator owners to know which of their generators are covered by which standards. I suggest there should be a global definition of minimum generator size to which all NERC Reliability Standards apply, much like the global definition of Bulk Electric System. To start the discussion let me suggest "generators with a net electrical output or 20 MW or greater, connected through a step-up transformer with a high voltage rating of 100 kV or higher."

The wording in the third bullet point for MOD-024-1 and MOD-025-1 in the Detail Description should be changed from "Consider Requiring" to just "Require".