

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Industry Webinar

Project 2021-01 Modifications to MOD-025 & PRC-019

May 11, 2023

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RELIABILITY | RESILIENCE | SECURITY



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Name	Company	Role
Jason Eruneo	Duke Energy	Chair
Steven Barnes	Peregrine Engineering	Vice chair
Kory Haag	ISO New England	Member
Michael (Bing) Xia	Powertech Labs	Member
Jonathan Q. Harris	Tennessee Valley Authority	Member
Ruth Kloecker	ITC Holdings	Member
David Schooley	ComEd (Exelon) Utilities	Member
Matthew Manley	Timmons Group	Member
Marques Montes	Arizona Public Service	Member
Steven Mueller	Ameren Services Company	Member
Joey Zukowski	Pacific Gas and Electric	Member
Chris Larson	NERC	Developer

- Meeting Purpose
- Project Background
- MOD-025 Summary of Changes (Draft 2)
- MOD-025 Requirement Language
- MOD-025 Implementation Plan
- MOD-025 Questions & Answers
- Break (time permitting)
- PRC-019 Summary of Changes (Draft 2)
- PRC-019 Requirement Language
- PRC-019 Implementation Plan
- PRC-019 Questions & Answers
- Project Timeline

- Industry outreach
- Standards development process: openness, consensus building
- Share the background; why do this project?
- Address questions prior to ballot period
- Understand industry concerns
- Encourage participation from industry
- Improve the final product (revised standards)
- Reduce risk to BES reliability

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- Model accuracy is essential in transmission planning.
- PPMVTF developed the SAR to revise MOD-025-2 to address issues regarding verification and data reporting of generator active and reactive power capability.
- Implementation of the standard has rarely produced data that is suitable for planning models (i.e., the stated purpose of the standard).
- The current MOD-025-2 verification testing activities require significant time, expertise, and coordination; however, they do not result in data that should be used by planners for modeling purposes.
- Project aims to retain testing activities are useful and focus on more effective means of collecting useful data for planning models. RSTC endorsed the SAR on October 19, 2020.
- Overlap with Project 2020-02 SAR for transmission-connected dynamic reactive resources.

- Added verification date language to R1/R2
- Aligned R1.3.3 and R2.3.3 language with Attachment 1
- Updated language to R3 and R4 based on comments
- Updated Attachment 1-3 based on comments
- Revised Implementation Plan to allow for 66 month periodicity to carry forward for existing Facilities

4. Applicability:

4.1. Functional Entities:

- 4.1.1** Generator Owner
- 4.1.2** Transmission Owner
- 4.1.3** Transmission Planner

- 4.2. Facilities:** For the purpose of this standard, the term, “applicable Facility” or “Facility” shall mean any one of the following:
- 4.2.1** Individual generating resource identified through Inclusion I2 of the BES definition.
 - 4.2.2** Generating plant/Facility identified through Inclusion I2 of the BES definition.
 - 4.2.3** Generating plant/Facility of dispersed power producing resources identified through Inclusion I4 of the BES definition.
 - 4.2.4** Dynamic reactive devices identified through Inclusion I5 of the BES definition with a gross (individual or aggregate) nameplate rating greater than 20 MVA including, but not limited to:
 - 4.2.4.1** Synchronous condenser; and
 - 4.2.4.2** Flexible alternating current transmission system (FACTS) devices.
 - 4.2.5** **High-voltage direct current (HVDC)** terminal equipment including:
 - 4.2.5.1** Voltage source converter (VSC).
 - 4.2.6** **Facilities meeting an exclusion of the BES definition are exempt as an applicable Facility.**

MOD-025-2	MOD-025-3
MOD-025-2 R1 (Real) & R2 (Reactive)	R1
MOD-025-2 R3	R2
New Requirement	R3
New Requirement	R4

- R1.** Each Generator Owner shall verify the Real Power and Reactive Power capability of its applicable Facilities and inform its Transmission Planner as follows: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1.** Verify the Real Power capability, if applicable, of its applicable Facilities in accordance with Attachment 1.
 - 1.2.** Verify the Reactive Power capability of its applicable Facilities in accordance with Attachment 1.
 - 1.3.** Submit the following information, in accordance with Attachment 2, to the Transmission Planner within 30 calendar days after the verification date: **The verification date, as specified in Attachment 2, should represent the date that the engineering review or engineering analysis is complete. The verification date is the basis of the recurring periodicity.**
 - 1.3.1.** ~~One-line~~ **Simplified one-line** diagram representing the **applicable** Facility;
 - 1.3.2.** Composite capability curve and associated PQ data table; and
 - 1.3.3.** Documentation ~~showing the engineering basis,~~ **of the underlying assumptions, design criteria, and methods for the chosen** verification methodology ~~and/or applicable data for the verification method~~ **from Attachment 1.**

- R2.** Each Transmission Owner shall verify the Real Power and Reactive Power capability of its applicable Facilities and inform its Transmission Planner as follows: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 2.1.** Verify the Real Power capability, if applicable, of its applicable Facilities in accordance with Attachment 1.
 - 2.2.** Verify the Reactive Power capability of its applicable Facilities, in accordance with Attachment 1.
 - 2.3.** Submit the following information ~~per,~~ **in accordance with** Attachment 2, to the Transmission Planner within 30 calendar days after the verification date. **The verification date, as specified in Attachment 2, should represent the date that the engineering review or engineering analysis is complete. The verification date is the basis of the recurring periodicity.**
 - 2.3.1.** ~~One-line~~ **Simplified one-line** diagram representing the **applicable** Facility;
 - 2.3.2.** Composite capability curve and associated PQ data table; and
 - 2.3.3.** Documentation ~~showing the engineering basis, of the underlying~~ **assumptions, design criteria, and methods for the chosen** verification methodology ~~and/or applicable data for the verification method~~ **from Attachment 1.**

- R3.** Each Transmission Planner shall review the information submitted by each Generator Owner or Transmission Owner in accordance with Requirement R1, R2, or R4 and provide a written response to the submitter within 90 calendar days ~~containing~~from receiving each submission. The written response shall contain one of the following:
[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]
- Notification that the Transmission Planner has reviewed the information and has not identified any technical concerns with the Real and Reactive Power capability information submitted by the Generator Owner or Transmission Owner; or
 - Notification that the Transmission Planner has reviewed the information and has identified a technical concern, including the basis for the technical concern.

- R4.** Each Generator Owner or Transmission Owner receiving a notification of a technical concern under Requirement R3 shall provide a written response to its Transmission Planner within 90 calendar days ~~containing~~ from receiving a notification. The written response shall contain one of the following: [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]
- Updated capability information in accordance with ~~Requirements~~ Requirement R1 or R2;
 - A ~~mutually agreed upon~~ plan ~~with its Transmission Planner~~ to update the capability information in accordance with ~~Requirements~~ Requirement R1 or R2; or
 - Technical justification and supporting evidence for maintaining the existing capability information in accordance with ~~Requirements~~ Requirement R1 or R2.

1. The applicable entity designates the verification date and notates the verification date in a summary report (refer to Attachment 2). The verification date should represent the date that the engineering review or engineering analysis is complete. The verification date is the basis of the recurring periodicity.
2. Verify each new applicable Facility within 180 calendar days of its commercial operation date.
3. Verify each existing applicable Facility at a periodicity not to exceed ~~ten years~~120 calendar months from the last verification date-, unless it meets the following condition:
 - The Facility has been on a planned or unplanned outage of 180 days or greater, which overlaps its scheduled verification date. Verify the applicable Facility within 180 calendar days of its return to service date.
4. Verify an existing applicable Facility within 180 calendar days of the discovery of a change that affects its Real Power or Reactive Power capability by more than a 10 percent increase or decrease of the nameplate rating and is expected to last more than 180 calendar days.

The Generator Owner or Transmission Owner shall utilize and document one or more of the following methodologies to verify the Facility Real and Reactive Power capability for all equipment expected to be in-service for normal operation. The engineering review or engineering analysis shall include the underlying assumptions, design criteria, and methods used to create the Facility's composite capability curve under Section II, Items 6-8.

- ~~• Perform an engineering review of all Real and Reactive Power Facility capability information including but not limited to in-service equipment design limitations, excitation limiter settings, and operational limitations;~~
- Utilize staged testing data, in accordance with Section III, obtained from a date within 365 calendar days prior to verification date, and perform engineering analysis as needed per Note 1, that validates the generator Facility capability; or
- Utilize operational data, in accordance with Section III, obtained from a date within 365 calendar days prior to verification date, and perform engineering analysis as needed per Note 1, that validates the generator Facility capability; or
- Perform an engineering review of all Real and Reactive Power Facility capability information including, but not limited to, in-service equipment design limitations, excitation limiter settings, and operational limitations.

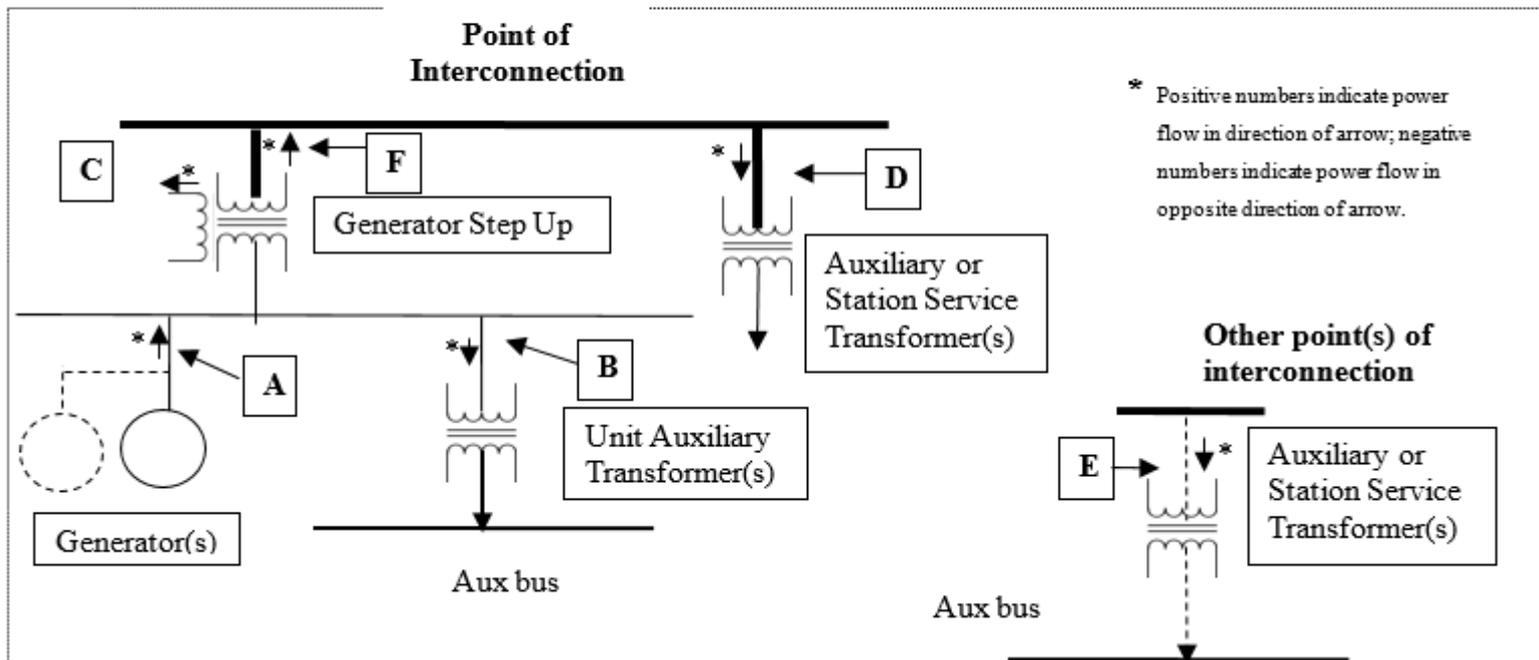
6. For an applicable Facility as identified in Section 4.2.1, 4.2.2, or 4.2.4.1, when performing verification on an individual unit basis, create a graphical representation of the steady-state composite capability curve (CCC) for the Real Power and Reactive Power. The steady-state CCC shall include at a minimum the following:
 - 6.1. The generator nameplate steady-state Real Power and Reactive Power capability curve, or the synchronous condenser nameplate steady-state Reactive Power capability curve, provided by the equipment manufacturer. **If the equipment manufacturer curve is not available, the curve shall be derived using the best available data.**
 - 6.1.1 The curve shall represent generator/synchronous condenser capability at a nominal voltage of 1.0 per unit at the generator/synchronous condenser terminal; and
 - 6.1.2 The curve shall notate the operating conditions that dictate the power capability, for example H2 pressure, ambient temperature, or other conditions.
 - 6.2. Excitation limiters, if more restrictive than the equipment ~~manufacturer's~~ nameplate capability curve, at nominal voltage 1.0 per unit;
 - 6.3. Identification of any Real Power or Reactive Power operational limitations, ~~1,~~ if applicable;
 - 6.4. Identification of the steady-state minimum (P_{\min}) and maximum (P_{\max}) Real Power output at the generator terminal(s), based on the least restrictive seasonal or operating conditions; and
 - 6.5. Identification of final PQ curve, which defines the normal operating region.

MOD-025-3 Attachment 2 – BES Facility Capability Report

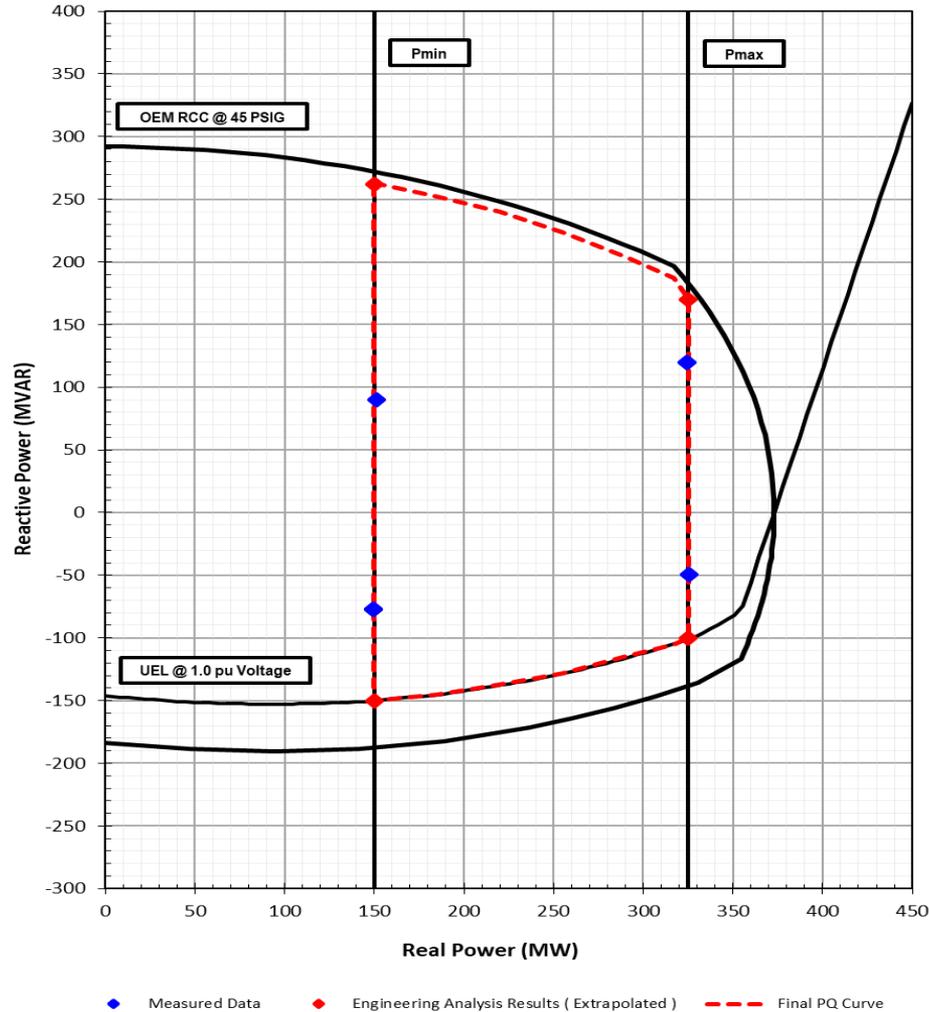
A completed report shall contain the following information at a minimum per Requirement R1 and R2:

- Section I: One-line diagram of the applicable Facility
- Section II: Composite capability curve
- ~~and associated Section III: Associated~~ PQ data table
- Section ~~IV~~III: Documentation showing the engineering basis and verification methodology

Section I. Provide simplified one-line diagram representing the applicable Facility showing plant auxiliary Load connections. Identify on the one-line diagram where the composite capability curve is represented.



Example - 373 MVA Steam Turbine-Generator
 Composite Capability Curve @ 1.0 p.u. Voltage



		Date
FERC approval date (example only)		12/31/2023
Effective Date of MOD-025-3 (R3 & R4)	+ 1 year	01/01/2025
Compliance Date (R1 & R2) (newly applicable units)	+ 2 years	01/01/2027

Initial Performance of Periodic Requirements:

Applicable entities shall initially comply the periodic requirements of MOD-025-3 (Requirement R1 and R2) within 66 calendar months of their last performance under the respective requirements in the requested Retired Reliability Standard (MOD-025-2 Requirement R1, R2, and R3). When the periodic timeframe for activity falls between the effective date of MOD-025-3 and the Compliance Date for the respective requirement, the applicable Entity shall comply with the Requirement(s) of MOD-025-3 by the Compliance Date.



Questions and Answers

Name	Company	Role
Jason Eruneo (chair)	Duke Energy	Member
Steven Barnes (vice-chair)	Peregrine Engineering	Member
Jonathan Q. Harris	Tennessee Valley Authority	Member
Matthew Manley	Timmons Group	Member
Marques Montes	Arizona Public Service	Member
Steven Mueller	Ameren Services Company	Member
Chris Larson	NERC	Developer

- PRC-019-2 addresses the reliability issue of miscoordination between generator capability, control systems, and protection functions.
- PRC-019-2 was developed with a bias toward synchronous generation and does not sufficiently outline the requirements for all generation resource types.
- The project aims to address a number of issues identified by the SPCS and revise the standard to be inclusive of all types of generation resources.
- The SAR was endorsed by the NERC Planning Committee (PC) on March 4, 2020.
- The MOD-025-2 and PRC-019-2 SARs were accepted and authorized for informal posting at the January 20, 2021 SC meeting.
- The project will also address whether transmission-connected dynamic reactive resources should be applicable for PRC-019-3.

- Added Protection System in requirement based on revised definition, which includes protective function (PRC-005)
- Reoccurring periodicity removed from R1
- Footnote added R1.2 for voltage control mode capability

4.2. Facilities: For the purpose of this standard, the term, “applicable Facility” or “Facility” shall mean any one of the following:

4.2.1 Individual generating resource identified through Inclusion I2 of the BES definition.

4.2.2 Generating plant/Facility identified through Inclusion I2 of the BES definition.

4.2.3 Individual synchronous condenser greater than 20 MVA (gross nameplate rating) directly connected to the BES.

~~**4.2.3** Dynamic reactive resources identified through Inclusion I5 of the BES definition with a gross (individual or aggregate) nameplate rating greater than 20 MVA including:~~

~~**4.2.3.1** Synchronous condenser.~~

4.2.4 Inverter-based resource (IBR) generating plant/Facility ~~identified through Inclusion I4 of the BES definition,~~ **greater than 75 MVA (gross nameplate rating)** including:

4.2.4.1 Individual IBR units;

4.2.4.2 Collector bus(es) and collector feeder(s);

4.2.4.3 Static or dynamic reactive compensating devices;

4.2.4.4 Main power transformer (MPT);¹

PRC-019-2	PRC-019-3
PRC-019-2 R1 (synchronous)	R1.1
PRC-019-2 R1 (IBR)	R1.2
PRC-019-2 R2	R2

- R1.** ~~At a maximum of every six calendar years, each~~**Each** Generator Owner and Transmission Owner with applicable Facilities shall coordinate³ the voltage regulating system controls, with the applicable equipment capabilities and settings of the applicable ~~protective~~**Protection System devices and** functions.⁴ Equipment capabilities, control functions, and protective functions for the applicable Facilities include, but are not limited to those listed in Attachment 1. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1.** For synchronous generators or synchronous condensers, assuming the normal automatic voltage regulator control loop and steady-state system operating conditions, verify the following coordination items:
- 1.1.1.** The in-service limiter functions⁵⁴ are set to operate before the protective functions of the applicable Facility in order to avoid disconnecting the generator unnecessarily.
- 1.1.2.** The applicable in-service protective functions are set to operate to isolate or de-energize equipment in order to limit the extent of damage when operating conditions exceed equipment capabilities.

- 1.2.** For IBR generating Facilities, assuming the voltage control mode⁵ is enabled in the power plant controller and/or IBR unit(s)⁶ and steady-state system operating conditions, verify the following coordination items:
 - 1.2.1.** The in-service control functions of the power plant controller are set to operate before the protective functions of the applicable Facilities in order to avoid disconnecting any of the Facilities listed under Section 4.2.4 unnecessarily.
 - 1.2.2.** The in-service control functions of IBR unit(s) are set to operate before protective functions of the applicable Facilities in order to avoid disconnecting any of the Facilities listed under Section 4.2.4 unnecessarily.
 - 1.2.3.** The applicable in-service protective functions are set to operate to isolate or de-energize equipment in order to limit the extent of damage when operating conditions exceed equipment capabilities.

R2. Each Generator Owner and Transmission Owner shall perform the coordination described in Requirement R1 prior to implementation of systems, equipment, or settings changes that will affect the coordination described in Requirement R1; ~~and update associated.~~ **Associated** coordination documentation **shall be updated** within 90 calendar days after the return to in-service date. These possible systems, equipment, or settings changes include, but are not limited to, the following:
[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]

- Voltage regulating settings or equipment changes;
- Protective function settings or component changes;
- IBR unit, synchronous generator, or synchronous condenser equipment capability changes;
- IBR unit, synchronous generator, or synchronous condenser step-up transformer changes;
- IBR unit control system firmware or settings changes; or
- ~~Power~~ **IBR generating Facility power** plant controller firmware or settings changes.

- B. IBR generating Facility equipment capabilities, control functions, and protective functions, which shall be coordinated if enabled, include but are not limited to:
- Transformer overvoltage protective function and associated control function;
 - Transformer undervoltage protective function and associated control function;
 - Transformer volts per hertz capability ~~and~~ protective function and associated control function;
 - Collector bus overvoltage protective function and associated control function;
 - Collector bus undervoltage protective function and associated control function;
 - Reactive compensating devices voltage control functions and associated control function;
 - Reactive compensating devices voltage protective function and associated control function;

		Date
FERC approval date (example only)		12/31/2023
Effective Date of PRC-019-3 R2	+ 1 year	01/01/2025
Effective Date of PRC-019-3 R1	+ 1 year	01/01/2026

Initial Performance of Requirement R1:

For an applicable Facility commissioned after the Effective Date of PRC-019-3, which has not previously performed a coordination study under PRC-019-2 Requirement R1, the Applicable Entities shall comply with the requirements of PRC-019-3 prior to outputting Real or Reactive Power to the BES.

- Webinar & presentation will be available on project website, related files page
- 45-day additional ballot and comment period
 - Scheduled for April 25 to June 8, 2023
- Additional ballot and comment (if needed)
 - September to November 2023
- NERC Board Adoption
 - December 2023



Questions and Answers