NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

DRAFT Reliability Standard Audit Worksheet[1]

MOD-026-2 – Verification of Dynamic Models and Data for BES Connected Facilities

This section to be completed by the Compliance Enforcement Authority.

Audit ID:	Audit ID if available; or REG-NCRnnnnn-YYYYMMDD
Registered Entity:	Registered name of entity being audited
NCR Number:	NCR######
Compliance Enforcement Authority:	Region or NERC performing audit
Compliance Assessment Date(s)[2]:	Month DD, YYYY, to Month DD, YYYY
Compliance Monitoring Method:	[On-site Audit | Off-site Audit | Spot Check]
Names of Auditors:	Supplied by CEA

Applicability of Requirements

	BA	DP	GO	GOP	IA	LSE	PC	PSE	RC	RP	RSG	TO	TOP	TP	TSP
R1							X							X	
R2			X									X			
R3			X												
R4			X									X			
R5			X									X			
R6			X									X			
R7			X									X			
R8														X	
R9			X									X			

Legend:

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[1] NERC developed this Reliability Standard Audit Worksheet (RSAW) language in order to facilitate NERC's and the Regional Entities' assessment of a registered entity's compliance with this Reliability Standard. The NERC RSAW language is written to specific versions of each NERC Reliability Standard. Entities using this RSAW should choose the version of the RSAW applicable to the Reliability Standard being assessed. While the information included in this RSAW provides some of the methodology that NERC has elected to use to assess compliance with the requirements of the Reliability Standard, this document should not be treated as a substitute for the Reliability Standard or viewed as additional Reliability Standard requirements. In all cases, the Regional Entity should rely on the language contained in the Reliability Standard itself, and not on the language contained in this RSAW, to determine compliance with the Reliability Standard. NERC's Reliability Standards can be found on NERC's website. Additionally, NERC Reliability Standards are updated frequently, and this RSAW may not necessarily be updated with the same frequency. Therefore, it is imperative that entities treat this RSAW as a reference document only, and not as a substitute or replacement for the Reliability Standard. It is the responsibility of the registered entity to verify its compliance with the latest approved version of the Reliability Standards, by the applicable governmental authority, relevant to its registration status.

The NERC RSAW language contained within this document provides a non-exclusive list, for informational purposes only, of examples of the types of evidence a registered entity may produce or may be asked to produce to demonstrate compliance with the Reliability Standard. A registered entity's adherence to the examples contained within this RSAW does not necessarily constitute compliance with the applicable Reliability Standard, and NERC and the Regional Entity using this RSAW reserves the right to request additional evidence from the registered entity that is not included in this RSAW. Additionally, this RSAW includes excerpts from FERC Orders and other regulatory references. The FERC Order cites are provided for ease of reference only, and this document does not necessarily include all applicable Order provisions. In the event of a discrepancy between FERC Orders, and the language included in this document, FERC Orders shall prevail.

[2] Compliance Assessment Date(s): The date(s) the actual compliance assessment (on-site audit, off-site spot check, etc.) occurs.

DRAFT NERC Reliability Standard Audit Worksheet

Text entry area with Green background:	Entity-supplied information
Text entry area with white background:	Auditor-supplied information

Findings

(This section to be completed by the Compliance Enforcement Authority)

Req.	Finding	Summary and Documentation	Functions Monitored
R1			
R2			
R3			
R4			
R5			
R6			

Req.	Areas of Concern

Req.	Recommendations

Req.	Positive Observations

Subject Matter Experts

Identify the Subject Matter Expert(s) responsible for this Reliability Standard.

Registered Entity Response (Required; Insert additional rows if needed):

SME Name	Title	Organization	Requirement(s)

R1 Supporting Evidence and Documentation

Each Transmission Planner and its Planning Coordinator, shall jointly develop dynamic model verification requirements and processes. The dynamic model verification requirements and processes shall be made available to the Generator Owner and Transmission Owner by the Transmission Planner, and include at a minimum the following:

1.1. Acceptable positive sequence dynamic models, format, and level of detail;

1.2. Acceptable electromagnetic transient (EMT) models, format, and level of detail[3] ;

1.3. Acceptance criteria used by the Transmission Planner to determine disposition in Requirement R8 including at a minimum the following:

1.3.1. model parameterization checks;

1.3.2. model usability, initialization, and interoperability; and

1.3.3. model submittal requirements.[4]

1.4. Process for Generator Owner or Transmission Owner to provide verified models to the Transmission Planner;

1.5. Process by which verified model(s) are submitted to the applicable Planning Coordinator, after the model(s) meets acceptance criteria of Part 1.3; and

1.6. Process for Generator Owner or Transmission Owner to obtain the model(s) contained in the Transmission Planner's database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 days of receiving a written request.

M1. Each Transmission Planner and each Planning Coordinator must provide dated evidence such as document(s), webpage(s), or web portal(s) outlining the model requirements and processes that are jointly developed. Each Transmission Planner shall also have evidence showing it made available to Generator Owner or Transmission Owner the model requirements and processes in accordance with Requirement R1.

Registered Entity Response (Required):
Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

[3] Detailed EMT modeling requirements are developed by the Transmission Planner to ensure consistent EMT models are provided based on the types of studies being performed and the specific EMT simulation tools being used.

[4] Model submittal requirements needed by the Transmission Planner may include, but are not limited to, required data files and inclusions needed in the model report.

Provide the following evidence, or other evidence to demonstrate compliance.	
The jointly developed dynamic model verification requirements and processes	
For Transmission Planners, evidence the jointly developed dynamic model verification requirements and processes were made available to applicable Generation Owner(s) and Transmission Owner(s).	

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R1

This section to be completed by the Compliance Enforcement Authority

	Confirm the entity jointly developed dynamic model verification requirements and processes with the applicable Transmission Planner or Planning Coordinator
	Confirm the entity jointly developed dynamic model verification requirements and processes contain, at a minimum, all of the required items in subparts 1.1 through 1.6.
	1.1. Acceptable positive sequence dynamic models, format, and level of detail
	1.2. Acceptable electromagnetic transient (EMT) models, format, and level of detail[5]
	1.3. Acceptance criteria used by the Transmission Planner to determine disposition in Requirement R8 including at a minimum the following: **1.3.1.** model parameterization checks; **1.3.2.** model usability, initialization, and interoperability; and **1.3.3.** model submittal requirements. [6]

[5] Detailed EMT modeling requirements are developed by the Transmission Planner to ensure consistent EMT models are provided based on the types of studies being performed and the specific EMT simulation tools being used.

[6] Model submittal requirements needed by the Transmission Planner may include, but are not limited to, required data files and inclusions needed in the model report.

	1.4. Process for Generator Owner or Transmission Owner to provide verified models to the Transmission Planner;
	1.5. Process by which verified model(s) are submitted to the applicable Planning Coordinator, after the model(s) meets acceptance criteria of Part 1.3; and
	1.6. Process for Generator Owner or Transmission Owner to obtain the model(s) contained in the Transmission Planner's database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 days of receiving a written request.
	If the entity is a Transmission Planner, verify the dynamic model verification requirements and processes were made available to the applicable Generator Owner(s) and Transmission Owner(s).

Auditor Notes:

R2 Supporting Evidence and Documentation

R2. For synchronous generation identified in Section 4.2.1 or 4.2.2 or a synchronous condenser identified in Section 4.2.4.1, each Generator Owner or Transmission Owner shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following:

2.1. Manufacturer, model number (if available), and type of generator/synchronous condenser, excitation system hardware, and Protection System(s) of Part 2.3;

2.2. Model(s) representing the generator/synchronous condenser, and associated excitation system including voltage regulator, impedance compensation, power system stabilizer, and outer-loop controls which impact dynamic volt/volt-ampere reactive (VAR) performance;

2.3. Model(s) representing enabled excitation limiters and enabled Protection Systems that directly trip the prime mover or generator/synchronous condenser. Protection Systems that shall be modeled include phase over- and under-voltage, stator-phase overcurrent, voltage restrained time overcurrent, field overcurrent, loss of field, out-of-step, phase-distance, and volts per hertz protection; and

2.4. Validation of the positive sequence dynamic model(s) of Part 2.2 response using the recorded response for a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.

M2. The Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R2 and provided the verified model(s) and accompanying information to its Transmission Planner in accordance with the periodicity.

Registered Entity Response (Required):
Question: Does the entity own synchronous generation identified in Section 4.2.1 or 4.2.2 or a synchronous condenser identified in Section 4.2.4.1? ☐ Yes ☐ No
If Yes, provide a list of applicable generation and synchronous condensers.
If No, how was the determination of applicable units ascertained?
[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
If the question above was answered yes and a list was provided above, for each item provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R2

This section to be completed by the Compliance Enforcement Authority

	If applicable, verify the entity provided a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.
	For all, or a sample of applicable facilities, verify the verified model(s) and accompanying information includes, at a minimum, all of the required items in subparts 2.1 through 2.4.
	2.1. Manufacturer, model number (if available), and type of generator/synchronous condenser, excitation system hardware, and Protection System(s) of Part 2.3;
	2.2. Model(s) representing the generator/synchronous condenser, and associated excitation system including voltage regulator, impedance compensation, power system stabilizer, and outer-loop controls which impact dynamic volt/volt-ampere reactive (VAR) performance;
	2.3. Model(s) representing enabled excitation limiters and enabled Protection Systems that directly trip the prime mover or generator/synchronous condenser. Protection Systems that shall be modeled include phase over- and under-voltage, stator-phase overcurrent, voltage restrained time overcurrent, field overcurrent, loss of field, out-of-step, phase-distance, and volts per hertz protection; and
	2.4. Validation of the positive sequence dynamic model(s) of Part 2.2 response using the recorded response for a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.

Auditor Notes:

R3 Supporting Evidence and Documentation

R3. For synchronous generation identified in Section 4.2.1 or 4.2.2, each Generator Owner shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following:

3.1. Manufacturer, model number (if available), type of prime mover, type of governor, type of control, and Protection System(s) of Part 3.3;

3.2. Model(s) representing the prime mover, governor control system, and any other controls which impact the dynamic active power or frequency performance due to a system disturbance (e.g. load controller), but excluding automatic generation control;

3.3. Model(s) representing enabled Protection Systems that directly trip the prime mover or generator. Protection Systems that shall be modeled include over- and under-frequency elements. In addition, model(s) representing enabled prime mover over- and under-speed trip functions that directly trip the prime mover/generator; and

3.4. Validation of the positive sequence dynamic model(s) of Part 3.2 response using the recorded response for a dynamic active power or frequency event from either a staged test or a measured system disturbance in which perceived frequency deviates per Attachment 1, Note 1.

M3. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R3 and provided the verified model(s) and accompanying information to its Transmission Planner in accordance with the periodicity.

Registered Entity Response (Required):
Question: Does the entity own synchronous generation identified in Section 4.2.1? ☐ Yes ☐ No
If Yes, provide a list of applicable generation.
If No, how was the determination of applicable units ascertained?

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
If the question above was answered yes and a list was provided above, for each item provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R3

This section to be completed by the Compliance Enforcement Authority

	If applicable, verify the entity provided a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.
	For all, or a sample of applicable facilities, verify the verified model(s) and accompanying information includes, at a minimum, all of the required items in subparts 3.1 through 3.4.
	3.1. Manufacturer, model number (if available), type of prime mover, type of governor, type of control, and Protection System(s) of Part 3.3;
	3.2. Model(s) representing the prime mover, governor control system, and any other controls which impact the dynamic active power or frequency performance due to a system disturbance (e.g. load controller), but excluding automatic generation control;
	3.3. Model(s) representing enabled Protection Systems that directly trip the prime mover or generator. Protection Systems that shall be modeled include over- and under-frequency elements. In addition, model(s) representing enabled prime mover over- and under-speed trip functions that directly trip the prime mover/generator; and
	3.4. Validation of the positive sequence dynamic model(s) of Part 3.2 response using the recorded response for a dynamic active power or frequency event from either a staged test or a measured system disturbance in which perceived frequency deviates per Attachment 1, Note 1.

Auditor Notes:

R4 Supporting Evidence and Documentation

R4. For inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, and VSC HVDC identified in Section 4.2.5.2, each Generator Owner or Transmission Owner shall provide a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1. The verified model(s)and accompanying information shall include at a minimum the following:

4.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s)[7] and power plant controller;

4.2. Model(s) representing the IBR unit(s), and associated reactive power control system[8] including the IBR unit's electrical control, power plant controller, auxiliary reactive resources, and other equipment which impacts plant voltage and reactive power dynamic response;

4.3. Model(s) representing enabled protections[9] and limiting functions,[10] that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and

4.4. Validation of the positive sequence dynamic model(s) of Part 4.2 response using the recorded response for a dynamic reactive power or voltage event from either a staged test or a system disturbance

M4. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R4 and provided the verified model(s) and accompanying information to its Transmission Planner in accordance with the periodicity.

[7] IBR unit includes the inverter, converter, wind turbine generator, or HVDC converter.
[8] Reactive power control system includes voltage reference control, reactive power reference control, and power factor control modes.
[9] Protection functions that shall be modeled include at a minimum ac over- and under-voltage protection.
[10] Limiting functions include active/reactive power limiting, active/reactive current limiting, or other limiting functions as may be involved in active/reactive power prioritization and disturbance ride-through.

Registered Entity Response (Required):
Question: Does the entity own inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, or VSC HVDC identified in Section 4.2.5.2?
☐ Yes ☐ No
If Yes, provide a list of the inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, or VSC HVDC identified in Section 4.2.5.2.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
Dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R4
The verified model(s) and accompanying information sent to its Transmission Planner in accordance with the periodicity.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R4

This section to be completed by the Compliance Enforcement Authority

	For all, or a sample of applicable facilities, review the entity's owned inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, or VSC HVDC identified in Section 4.2.5.2.
	For the items above, verify the entity provided a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.
	Verify the provided verified model(s)and accompanying information included at a minimum the following:
	4.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s) [11] and power plant controller;
	4.2. Model(s) representing the IBR unit(s), and associated reactive power control system[12] including the IBR unit's electrical control, power plant controller, auxiliary reactive resources, and other equipment which impacts plant voltage and reactive power dynamic response;
	4.3. Model(s) representing enabled protections[13] and limiting functions, [14] that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and
	4.4. Validation of the positive sequence dynamic model(s) of Part 4.2 response using the recorded response for a dynamic reactive power or voltage event from either a staged test or a system disturbance
Note to Auditor:	

Auditor Notes:

R5 Supporting Evidence and Documentation

R5. For inverter based resources (IBRs) identified in Section 4.2.3, LCC HVDC identified in Section 4.2.5.1, and VSC HVDC identified in Section 4.2.5.2, each Generator Owner or Transmission Owner shall provide a verified positive sequence dynamic model(s) with associated parameters, and

[11] IBR unit includes the inverter, converter, wind turbine generator, or HVDC converter.

[12] Reactive power control system includes voltage reference control, reactive power reference control, and power factor control modes.

[13] Protection functions that shall be modeled include at a minimum ac over- and under-voltage protection.

[14] Limiting functions include active/reactive power limiting, active/reactive current limiting, or other limiting functions as may be involved in active/reactive power prioritization and disturbance ride-through.

accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1. The verified model(s)shall include at a minimum the following: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]

5.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s), power plant controller;

5.2. Model(s) representing the IBR unit(s), and associated active power/frequency control including the IBR unit's electrical control, power plant controller, and other equipment which impacts plant active power or grid frequency dynamic response;

5.3. Model(s) representing enabled protections[15] and limiting functions, that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and

5.4. Validation of the positive sequence dynamic model of Part 5.2 response using the recorded response for a dynamic active power or frequency event from either a staged test or a measured system disturbance in which the power plant controller's or other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1.

M5. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R5 and provided the verified model(s) and accompanying information to its Transmission Planner in accordance with the periodicity.

Registered Entity Response (Required):

Question: Does the entity own inverter based resources (IBRs) identified in Section 4.2.3, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2?

☐ Yes ☐ No

If Yes, provide a list of the inverter based resources (IBRs) identified in Section 4.2.3, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Compliance Narrative:

Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

[15] Protection functions that shall be modeled include at a minimum over- and under-frequency protection.

Provide the following evidence, or other evidence to demonstrate compliance.
Dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R5
The verified model(s) and accompanying information sent to its Transmission Planner in accordance with the periodicity.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.

File Name	Document Title	Revision or Version	Document Date	Relevant Page(s) or Section(s)	Description of Applicability of Document

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R5

This section to be completed by the Compliance Enforcement Authority

	For all, or a sample of applicable facilities, review the entity's owned inverter based resources (IBRs) identified in Section 4.2.3, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2.
	For the items above, verify the entity provided a verified positive sequence dynamic model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.
	Verify the provided verified model(s)and accompanying information included at a minimum the following:
	5.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s) and power plant controller;
	5.2. Model(s) representing the IBR unit(s), and associated active power/frequency control including the IBR unit's electrical control, power plant controller, and other equipment which impacts plant active power or grid frequency dynamic response;
	5.3. Model(s) representing enabled protections[16] and limiting functions, that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; and

[16] Protection functions that shall be modeled include at a minimum over- and under-frequency protection.

	5.4. Validation of the positive sequence dynamic model of Part 5.2 response using the recorded response for a dynamic active power or frequency event from either a staged test or a measured system disturbance in which the power plant controller's or other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1.
Note to Auditor:	

Auditor Notes:

R6 Supporting Evidence and Documentation

R6. For inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices per Section 4.2.4.2, LCC HVDC identified in Section 4.2.5.1, and VSC HVDC identified in 4.2.5.2, each Generator Owner or Transmission Owner shall provide a verified EMT model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1. The verified model(s)and accompanying information shall include at a minimum the following

6.1. Attestation from respective original equipment manufacturer(s) (OEM) stating the structure of IBR unit model(s), power plant controller model, and auxiliary control devices model(s) represent the equipment supplied by the OEM.[17] If an attestation from an OEM is not obtainable, the Generator Owner or Transmission Owner shall document the reason;

6.2. Device test[18] results demonstrating a comparison of the IBR unit's response and the IBR unit's EMT model response for large signal disturbances. If device test results are not obtainable, the Generator Owner or Transmission Owner shall document the reason;

6.3. Facility EMT model with associated parameters representing the IBR unit(s), collector system, auxiliary devices, power plant controller, main transformer(s), and enabled protections and controls that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant;[19]

[17] The attestation shall include the equipment make, model number, software/firmware version number, and confirmation that all inverter control modes, control blocks, and protections are represented in the model.

[18] A device test that is hardware specific may include a factory type test, hardware in the loop test, or other manufacturer test to ensure the EMT model's large signal response emulates the supplied equipment to the extent possible.

[19] Enabled protections and controls that act on voltage, frequency, and/or current, or act on quantities derived from voltage, frequency, and/or current, which directly trip the IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant. Examples of protections include IBR unit DC reverse current, DC bus over- and under-voltage, DC voltage unbalance, DC overcurrent, AC over- and under-voltage protection (instantaneous

6.4. Validation of the Facility EMT model response using the recorded response for a dynamic reactive power or voltage event,[20] and for a dynamic active power or frequency event in which the power plant controller's or other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1, resulting from either a staged test or a system disturbance; and

6.5. Documentation comparing the response of positive sequence dynamic model(s) of Requirement R4 and R5 to the response of Facility EMT model of Requirement R6 for large signal disturbances.

M6. Each Generator Owner or Transmission Owner must provide dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R6 and provided the verified model(s) and accompanying information to its Transmission Planner in accordance with the periodicity.

Registered Entity Response (Required):

Question: Does the entity own inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2?

☐ Yes ☐ No

If Yes, provide a list of the inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices identified in Section 4.2.4.2, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Compliance Narrative:

Provide a brief explanation, in your own words, of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
Dated evidence for each applicable Facility that model(s) were verified in accordance with Requirement R6
The verified model(s) and accompanying information sent to its Transmission Planner in accordance with the periodicity.

and RMS), AC overcurrent, over- and under-frequency protection, feeder (equivalent) AC over- and under-voltage, feeder (equivalent) over- and under-frequency, PLL (or equivalent) loss of synchronism, and phase jump tripping.

20 LCC HVDC facilities are excluded from the dynamic voltage or VAR event portion of the requirement.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R6

This section to be completed by the Compliance Enforcement Authority

	For all, or a sample of applicable facilities, review the entity's owned inverter based resources (IBRs) identified in Section 4.2.3, FACTS devices per Section 4.2.4.2, LCC HVDC identified in Section 4.2.5.1, or VSC HVDC identified in Section 4.2.5.2.
	For the items above, verify the entity provided a verified EMT model(s) with associated parameters, and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, in accordance with the periodicity in MOD-026-2 Attachment 1.
	Verify the provided verified model(s)and accompanying information included at a minimum the following:
	6.1. Attestation from respective original equipment manufacturer(s) (OEM) stating the structure of IBR unit model(s), power plant controller model, and auxiliary control devices model(s) represent the equipment supplied by the OEM. [21] If an attestation from an OEM is not obtainable, the Generator Owner or Transmission Owner shall document the reason;
	6.2. Device test[22] results demonstrating a comparison of the IBR unit's response and the IBR unit's EMT model response for large signal disturbances. If device test results are not obtainable, the Generator Owner or Transmission Owner shall document the reason;
	6.3. Facility EMT model with associated parameters representing the IBR unit(s), collector system, auxiliary devices, power plant controller, main transformer(s), and enabled

[21] The attestation shall include the equipment make, model number, software/firmware version number, and confirmation that all inverter control modes, control blocks, and protections are represented in the model.

[22] A device test that is hardware specific may include a factory type test, hardware in the loop test, or other manufacturer test to ensure the EMT model's large signal response emulates the supplied equipment to the extent possible.

	protections and controls that either directly trip IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant; [23]
	6.4. Validation of the Facility EMT model response using the recorded response for a dynamic reactive power or voltage event, [24] and for a dynamic active power or frequency event in which the power plant controller's or other Facility active power controller's perceived frequency deviates per Attachment 1, Note 1, resulting from either a staged test or a system disturbance; and
	6.5. Documentation comparing the response of positive sequence dynamic model(s) of Requirement R4 and R5 to the response of Facility EMT model of Requirement R6 for large signal disturbances.
Note to Auditor: Exemptions are possible through Attachment 1 Row Number 11	

Auditor Notes:

R7 Supporting Evidence and Documentation

R7. Each Generator Owner or Transmission Owner shall provide an updated verified model(s), or a plan to verify the model(s), in accordance with one or more of Requirements R2, R3, R4, R5, or R6[25] to its Transmission Planner within 180 calendar days of making a hardware, software, firmware, control mode, or setting change to in-service equipment specified in Part 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, or 6.3 that alters the equipment response characteristic, in accordance with the periodicity in MOD-026-2 Attachment 1.

M7. Each Generator Owner or Transmission Owner must provide dated evidence such as an updated model or a plan to verify the model including transmittal date within 180 calendar days of making

[23] Enabled protections and controls that act on voltage, frequency, and/or current, or act on quantities derived from voltage, frequency, and/or current, which directly trip the IBR unit(s) or plant, or limit active/reactive output of the IBR unit or plant. Examples of protections include IBR unit DC reverse current, DC bus over- and under-voltage, DC voltage unbalance, DC overcurrent, AC over- and under-voltage protection (instantaneous and RMS), AC overcurrent, over- and under-frequency protection, feeder (equivalent) AC over- and under-voltage, feeder (equivalent) over- and under-frequency, PLL (or equivalent) loss of synchronism, and phase jump tripping.

[24] LCC HVDC facilities are excluded from the dynamic voltage or VAR event portion of the requirement.

[25] If an updated verification is performed, the 10 year period as outlined in MOD-026 Attachment 1 is reset.

changes to in-service equipment (e.g., email message, postal receipt, upload via web portal, etc.) in accordance with Requirement R7.

Registered Entity Response (Required):
Question: Did the entity make any hardware, software, firmware, control mode, or setting changes to in-service equipment specified in Part 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, or 6.3 that alters the equipment response characteristic? ☐ Yes ☐ No
If Yes, provide a list of the applicable changes.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
Any hardware, software, firmware, control mode, or setting changes to in-service equipment specified in Part 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, or 6.3 that alters the equipment response characteristic.
Associated evidence of submittal of such changes as required to the Transmission Planner.

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R7

This section to be completed by the Compliance Enforcement Authority

	Review any hardware, software, firmware, control mode, or setting changes to in-service equipment specified in Part 2.2, 2.3, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, or 6.3 that alters the equipment response characteristic.
	Verify updated verified model or a plan to verify the model was provided to the Transmission Planner within 180 calendar days, in accordance with the periodicity in MOD-026-2 Attachment 1.
Note to Auditor: If a plan was submitted instead of model updates, verify appropriate follow through occurred in accordance with Attachment 1 Row 6.	

Auditor Notes:

R8 Supporting Evidence and Documentation

R8. Each Transmission Planner shall, review materials submitted under Requirement R2-R7 or R9, and provide written response to the submitter within 120 calendar days from receiving each submission. The written response shall include one of the following:

- Notification of acceptance: the model and accompanying information meet the acceptance criteria established in Requirement R1, or
- Notification of denial: the model and accompanying information does not meet acceptance criteria established in Requirement R1, or information submitted is incomplete. The notification of denial shall include an explanation and supporting evidence.

M8. Each Transmission Planner must provide dated evidence such as review date of submitted model and accompanying information, review disposition (notification of acceptance or denial), and dated

response to the submitter (e.g., email message, postal receipt, etc.) within 90 calendar days of receipt in accordance with Requirement R8.

Registered Entity Response (Required):
Question: Did the entity receive any materials submitted under Requirement R2-R7 or R9? ☐ Yes ☐ No
If Yes, provide a list of the applicable submittals.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):
Compliance Narrative:
Provide a brief explanation, in your own words of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
List of applicable submittals
Written responses for each applicable submittal

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R8

This section to be completed by the Compliance Enforcement Authority

	For all or a sample, verify the entity reviewed materials submitted under Requirement R2-R7 or R9, and provided written responses to the submitters within 120 calendar days from receiving each submission.
	Verify the written responses included one of the following:
	• Notification of acceptance: the model and accompanying information meet the acceptance criteria established in Requirement R1, or
	• Notification of denial: the model and accompanying information does not meet acceptance criteria established in Requirement R1, or information submitted is incomplete. The notification of denial shall include an explanation and supporting evidence.
Note to Auditor:	

Auditor Notes:

R9 Supporting Evidence and Documentation

R9. Each Generator Owner or Transmission Owner receiving a notification of denial under Requirement R8 or a request from its Transmission Planner for a model review due to identified model or accompanying information deficiencies shall provide a written response to its Transmission Planner within 90 calendar days of receiving a notification or request, in accordance with the periodicity in MOD-026-2 Attachment 1. The written response shall contain one of the following:

- An updated verified model and accompanying information in accordance with Requirements R2-R6,
- A plan to verify the model in accordance with Requirements R2-R6, or
- Technical justification and supporting evidence for maintaining the current model.

M9. Each Generator Owner or Transmission Owner must provide dated evidence such as a response (e.g., email message, postal receipt, etc.) containing the information identified in Requirement R9 within 90 calendar days following receipt of notification of denial or request for model review.

Registered Entity Response (Required):

Question: Did the entity receive any notifications of denial under Requirement R8 or a request from its Transmission Planner for a model review due to identified model or accompanying information deficiencies?

☐ Yes ☐ No

If Yes, provide a list.

[Note: A separate spreadsheet or other document may be used. If so, provide the document reference below.]

Registered Entity Response (Required):

Compliance Narrative:

Provide a brief explanation, in your own words of how you comply with this Requirement. References to supplied evidence, including links to the appropriate page, are recommended.

Evidence Requested[i]:

Provide the following evidence, or other evidence to demonstrate compliance.
List of applicable notifications and requests
Written responses for each applicable notification and request

Registered Entity Evidence (Required):

The following information is requested for each document submitted as evidence. Also, evidence submitted should be highlighted and bookmarked, as appropriate, to identify the exact location where evidence of compliance may be found.					
File Name	**Document Title**	**Revision or Version**	**Document Date**	**Relevant Page(s) or Section(s)**	**Description of Applicability of Document**

Audit Team Evidence Reviewed (This section to be completed by the Compliance Enforcement Authority):

Compliance Assessment Approach Specific to MOD-026-2, R9

This section to be completed by the Compliance Enforcement Authority

	Verify the entity provided written responses to its Transmission Planner within 90 calendar days of receiving a notification or request, in accordance with the periodicity in MOD-026-2 Attachment 1.
	Verify the written responses included one of the following:
	• An updated verified model and accompanying information in accordance with Requirements R2-R6,
	• A plan to verify the model in accordance with Requirements R2–R6, or
	• Technical justification and supporting evidence for maintaining the current model.
Note to Auditor: If a plan was submitted instead of model updates, verify appropriate follow through occurred in accordance with Attachment 1 Row 6.	

Auditor Notes:

Additional Information

Reliability Standard

Add update

The full text of STD-MOD-026-2 may be found on the NERC Web Site (www.nerc.com) under "Program Areas & Departments", "Reliability Standards."

In addition to the Reliability Standard, there is an applicable Implementation Plan available on the NERC Web Site.

In addition to the Reliability Standard, there is background information available on the NERC Web Site.

Capitalized terms in the Reliability Standard refer to terms in the NERC Glossary, which may be found on the NERC Web Site.

Sampling Methodology

Sampling is essential for auditing compliance with NERC Reliability Standards since it is not always possible or practical to test 100% of either the equipment, documentation, or both, associated with the full suite of enforceable standards. The Sampling Methodology Guidelines and Criteria (see NERC website), or sample guidelines, provided by the Electric Reliability Organization help to establish a minimum sample set for monitoring and enforcement uses in audits of NERC Reliability Standards.

Regulatory Language

Add update

The Commission approved MOD-026-1 on March 20, 2014. Generator Verification Reliability Standards, Order No. 796, 79 Fed. Reg. 17011 (Mar. 27, 2014), 146 FERC ¶ 61,213 (2014).
http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/E-4.pdf

Higher MVA Applicability Threshold

P 37. The Commission found that the higher applicability thresholds of Reliability Standards MOD-026-1 and MOD-027-1 are appropriate for a continent-wide standard. The Commission indicated that: "Section 4.2.4 of Reliability Standard MOD-026-1 allows transmission planners to request a model review and related verification information in accordance with Requirement R5 from generators below the applicability threshold when 'technically justified' (where the simulated unit or plant response does not match the measured unit or plant response)." The Commission also stated that: "the higher applicability threshold does not excuse generator owners with small units from the expectation that estimated model data they provide to transmission planners for use in simulations will be accurate."

Process for Identifying "Technically Justified" Generating Units in MOD-026- 1

P 44. The Commission found that the basis and associated process for a transmission planner to demonstrate that it is "technically justified" for a generator owner below the applicability threshold to comply with Requirement R5 of Reliability Standard MOD-026-1 under Section 4.2.4 is sufficiently clear and workable. The

Commission stated that a universal approach could "unintentionally limit or otherwise undermine the regional knowledge and judgment of transmission planners." The Commission also noted that, "in the standard drafting team's technical judgment, discrepancies between simulations and measured data will be 'readily apparent.'"

P 45. The Commission found that: "local events that occur in the normal course of operations could provide adequate information for a transmission planner to demonstrate the need to invoke the technically justified provision of Reliability Standard MOD-026-1."

Violation Severity Level for MOD-026-1, Requirement R6

P 57. The Commission summarized its concern expressed in the NOPR regarding the proposed violation severity level for Requirement R6 of MOD-026-1 and Requirement R5 of MOD-027-1. Specifically, the Commission indicated that NERC did not propose any violation severity level for a violation of the last sentence of these requirements: "If the model is not useable, the [transmission planner] shall provide a technical description of why the model is not useable." The Commission noted in the NOPR that compliance with this obligation is no less important than compliance with the other obligations of these requirements. The Commission further stated that the lack of a violation severity level for this type of violation is inconsistent with the Commission's Violation Severity Level Guideline 3, because the proposed violation severity level does not address all of the obligations in these requirements.

P 58. The Commission directed NERC to "submit a violation severity level that addresses a transmission planner's obligation to provide a technical description of why a model submitted by a generation owner is not usable for Requirement R6 of MOD-026-1 and Requirement R5 of MOD-027-1."

Revision History for RSAW

Version	Date	Reviewers	Revision Description
1	11/09/2022	NERC Compliance Assurance	New Document

[i] Items in the Evidence Requested section are suggested evidence that may, but will not necessarily, demonstrate compliance. These items are not mandatory and other forms and types of evidence may be submitted at the entity's discretion.