

Mapping Document

Project 2020-06 Verifications of Models and Data for Generators

The standard drafting team (SDT) proposes the retirement of MOD-027-1 by combining the requirements of MOD-026-1 and MOD-027-1 into MOD-026-2. Due to the extensive revisions made to the combined standards, this mapping document is provided in lieu of a redline to last approved version. The approved standards and proposed standard have explanatory footnotes. For ease of use, this document does not include all footnotes unless relevant to the proposed changes.

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Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
<p>MOD-026-1, Requirement R1</p> <p>R1. Each Transmission Planner shall provide the following requested information to the Generator Owner within 90 calendar days of receiving a written request : <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> Instructions on how to obtain the list of excitation control system or plant volt/var control function models that are acceptable to the Transmission Planner for use in dynamic simulation, Instructions on how to obtain the dynamic excitation control system or plant volt/var control function model library block diagrams and/or data 	<p>MOD-026-2, Requirement R1</p> <p>R1. 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: <i>[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]</i></p> <p>1.1. Acceptable positive sequence dynamic models, format, and level of detail for Facilities specifically identified within Requirement R2–R5;</p> <p>1.2. Acceptable electromagnetic transient (EMT) models, format, and level of detail</p>	<p>MOD-026-2, Requirement R1 retains the intent of the old requirement. The new requirement involves the Transmission Planner taking proactive action. The Planning Coordinator becomes jointly involved in the defining the acceptable model requirements and processes. Acceptable EMT models and format are added to the requirement. The Transmission Planner defines acceptance criteria, which would be used to determine whether the model is acceptable and usable from their perspective. See Technical Rationale for additional information.</p>

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<p>sheets for models that are acceptable to the Transmission Planner, or</p> <ul style="list-style-type: none"> Model data for any of the Generator Owner’s existing applicable unit specific excitation control system or plant volt/var control function contained in the Transmission Planner’s dynamic database from the current (in-use) models, including generator MVA base. 	<p>for Facilities specifically identified within Requirement R6;</p> <p>1.3. Acceptance criteria used by the Transmission Planner to determine disposition under Requirement R8 including, at a minimum, the following:</p> <p>1.3.1. model parameterization checks;</p> <p>1.3.2. model usability, initialization, and interoperability; and</p> <p>1.3.3. model submittal requirements.</p> <p>1.4. Process for Generator Owner or Transmission Owner to provide verified models to the Transmission Planner;</p> <p>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</p> <p>1.6. Process for Generator Owner or Transmission Owner to obtain model data from the Transmission Planner’s database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 calendar days of receiving a written request.</p>	

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<p>MOD-026-1, Requirement R2</p> <p>R2. Each Generator Owner shall provide for each applicable unit, a verified generator excitation control system or plant volt/var control function model, including documentation and data (as specified in Part 2.1) to its Transmission Planner in accordance with the periodicity specified in MOD-026 Attachment 1. <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>2.1. Each applicable unit’s model shall be verified by the Generator Owner using one or more models acceptable to the Transmission Planner. Verification for individual units less than 20 MVA (gross nameplate rating) in a generating plant (per Section 4.2.1.2, 4.2.2.2, or 4.2.3.2) may be performed using either individual unit or aggregate unit model(s), or both. Each verification shall include the following:</p> <p>2.1.1. Documentation demonstrating the applicable unit’s model response matches the recorded response for a voltage excursion</p>	<p>MOD-026-1, Requirement R2 is addressed by MOD-026-2 Requirement R2 (synchronous) and R4 (IBR).</p> <p>MOD-026-2 Requirement R2</p> <p>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 asset owner (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, within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>2.1. Manufacturer, model number (if available), and type of generator/synchronous condenser, excitation system hardware, and Protection System(s) specified in Part 2.3;</p> <p>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</p>	<p>The old requirement is separated into two requirements based on the type of Facility being modeled. The technology specific requirement language for synchronous and IBR units is updated for each respective requirement. New language is added, so the model and associated parameters must represent in-service equipment of the Facility. The verified model must include enabled protection systems. See Technical Rationale for additional information.</p>

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<p>from either a staged test or a measured system disturbance,</p> <p>2.1.2. Manufacturer, model number (if available), and type of the excitation control system including, but not limited to static, AC brushless, DC rotating, and/or the plant volt/var control function (if installed),</p> <p>2.1.3. Model structure and data including, but not limited to reactance, time constants, saturation factors, total rotational inertia, or equivalent data for the generator,</p> <p>2.1.4. Model structure and data for the excitation control system, including the closed loop voltage regulator if a closed loop voltage regulator is installed or the model structure and data for the plant volt/var control function system,</p> <p>2.1.5. Compensation settings (such as droop, line drop, differential compensation), if used, and</p>	<p>dynamic volt/volt-ampere reactive (VAR) performance;</p> <p>2.3. Model(s) representing enabled excitation limiters and model(s) representing enabled Protection Systems that trip the prime mover or generator/synchronous condenser either directly or via lockout or auxiliary tripping relays. Protection Systems that shall be modeled include phase over- and under-voltage, out-of-step, and volts per hertz protection; and</p> <p>2.4. Validation of the positive sequence dynamic model(s) of Part 2.2 response using the recorded response of a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.</p> <p>MOD-026-2 Requirement R4</p> <p>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 asset owner (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</p>	

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<p>2.1.6. Model structure and data for power system stabilizer, if so equipped.</p>	<p>Planner, within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>4.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s) and power plant controller;</p> <p>4.2. Model(s) representing the IBR unit(s) and associated reactive power/voltage control system including the IBR unit’s electrical control, the Facility’s power plant controller, auxiliary reactive resources, and other equipment which impacts Facility voltage and reactive power dynamic response;</p> <p>4.3. Model(s) representing enabled protections and limiting functions, that either directly trip IBR unit(s) or Facility, or limit active/reactive output of the IBR unit or Facility; and</p> <p>4.4. Validation of the positive sequence dynamic model(s) of Part 4.2 response using the recorded response of a dynamic reactive power or voltage event from either a staged test or a measured system disturbance.</p>	

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<p>MOD-026-1, Requirement R3</p> <p>R3. Each Generator Owner shall provide a written response to its Transmission Planner within 90 calendar days of receiving one of the following items for an applicable unit:</p> <ul style="list-style-type: none"> • Written notification from its Transmission Planner (in accordance with Requirement R6) that the excitation control system or plant volt/var control function model is not usable, • Written comments from its Transmission Planner identifying technical concerns with the verification documentation related to the excitation control system or plant volt/var control function model, or • Written comments and supporting evidence from its Transmission Planner indicating that the simulated excitation control system or plant volt/var control function model response did not match the recorded response to a transmission system event. <p>The written response shall contain either the technical basis for maintaining the current model, the model changes, or a plan to</p>	<p>MOD-026-2, Requirement R9</p> <p>R9. Each Generator Owner or Transmission Owner shall provide a written response to its Transmission Planner after 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, within the timeframe in MOD-026-2 Attachment 1. The written response shall contain one of the following: <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> • An updated verified model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, • A plan to verify the model in accordance with Requirements R2, R3, R4, R5, or R6, or • A resubmission of the current model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, with additional technical justification and supporting evidence to address the notification of denial or model review from the Transmission Planner. 	<p>MOD-026-2, Requirement R9 retains the intent and most content of the old requirement. The requirement language is updated as needed based on the changes made to the other requirements. The reasons a Transmission Planner may issue a notification of denial are outlined in MOD-026-2 Requirement R8. See Technical Rationale for more information.</p>

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<p>perform model verification^[3] (in accordance with Requirement R2).</p>		
<p>MOD-026-1, Requirement R4</p> <p>R4. Each Generator Owner shall provide revised model data or plans to perform model verification^[4] (in accordance with Requirement R2) for an applicable unit to its Transmission Planner within 180 calendar days of making changes to the excitation control system or plant volt/var control function that alter the equipment response characteristic.⁵ [<i>Violation Risk Factor: Lower</i>] [<i>Time Horizon: Operations Planning</i>]</p> <p>Footnote 5: Exciter, voltage regulator, plant volt/var or power system stabilizer control replacement including software alterations that alter excitation control system equipment response, plant digital control system addition or replacement, plant digital control system software alterations that alter excitation control system equipment response, plant volt/var function equipment addition or replacement (such as static var systems, capacitor banks, individual unit excitation systems, etc.), a change in the voltage control mode (such as going from power factor control to automatic voltage control, etc.), exciter, voltage regulator, impedance compensator, or power system stabilizer settings change. Automatic changes</p>	<p>MOD-026-2, Requirement R7</p> <p>R7. Each Generator Owner or Transmission Owner, upon 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 its dynamic response characteristic(s),¹³ shall provide its Transmission Planner one of the following, within the timeframe in MOD-026-2 Attachment 1. [<i>Violation Risk Factor: Lower</i>] [<i>Time Horizon: Operations Planning</i>]</p> <ul style="list-style-type: none"> • An updated verified model(s) in accordance with each Requirement R2, R3, R4, R5, or R6 applicable to the change being made, or • A plan to verify the model(s) in accordance with Requirement R2, R3, R4, R5, or R6. <p>Footnote 13: Such changes include: (a) exciter, voltage regulator, plant volt/var, power system stabilizer, or governor control replacement including software alterations; (b) addition or replacement of protection systems that deploy under- and over- voltage and/or under- and over- frequency elements; (c) plant digital control system addition or replacement; (d) plant volt/var function equipment addition or replacement (such as</p>	<p>MOD-026-2, Requirement R7 retains the intent of the old requirement. The new requirement refers to the in-service equipment outlined in Requirements R2–R6, and footnote ¹³ specifies the type of changes that are included. See Technical Rationale for more information.</p>

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in settings that occur due to changes in operating mode do not apply to Requirement R4.	static var systems, capacitor banks, individual unit excitation systems, or other equipment); (e) software, firmware or setting change in the equipment (such as exciter, voltage regulator, power system stabilizer, excitation limiter, governor, plant controller, FACTS devices or IBR unit, or other equipment.) that alters its dynamic response characteristics; (f) a permanent change in the voltage or frequency control mode (such as manually switching the voltage regulator from power factor control to automatic voltage control); or (g) any other equipment change that alters its dynamic response characteristic. Automatic change of control mode or a control setting that is implemented in the plant control systems are excluded.	
<p>MOD-026-1, Requirement R5</p> <p>R5. Each Generator Owner shall provide a written response to its Transmission Planner, within 90 calendar days following receipt of a technically justified⁶ unit request from the Transmission Planner to perform a model review of a unit or plant that includes one of the following: <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> • Details of plans to verify the model (in accordance with Requirement R2), or • Corrected model data including the source of revised model data such as discovery of manufacturer test values to 	<p>MOD-026-2, Requirement R9</p> <p>R9. Each Generator Owner or Transmission Owner shall provide a written response to its Transmission Planner after 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, within the timeframe in MOD-026-2 Attachment 1. The written response shall contain one of the following: <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p>	<p>MOD-026-2, Requirement R9 incorporates the intent of the old requirement. Footnote ⁶ is no longer needed, since a model review request would identify model deficiencies. See Technical Rationale for more information.</p>

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<p>replace generic model data or updating of data parameters based on an on-site review of the equipment.</p> <p>Footnote 6: Technical justification is achieved by the Transmission Planner demonstrating that the simulated unit or plant response does not match the measured unit or plant response.</p>	<ul style="list-style-type: none"> • An updated verified model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, • A plan to verify the model in accordance with Requirements R2, R3, R4, R5, or R6, or • A resubmission of the current model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, with additional technical justification and supporting evidence to address the notification of denial or model review from the Transmission Planner. 	
<p>MOD-026-1, Requirement R6</p> <p>R6. Each Transmission Planner shall provide a written response to the Generator Owner within 90 calendar days of receiving the verified excitation control system or plant volt/var control function model information in accordance with Requirement R2 that the model is usable (meets the criteria specified in Parts 6.1 through 6.3) or is not usable.</p> <p>6.1. The excitation control system or plant volt/var control function model</p>	<p>MOD-026-2, Requirement R8</p> <p>R8. Each Transmission Planner shall review the model(s) and accompanying information submitted under Requirement R2–R7 or R9, and provide written response to the submitter after receiving each submission, within the timeframe in MOD-026-2 Attachment 1. The written response shall include one of the following: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</p> <ul style="list-style-type: none"> • Notification of acceptance: the model and accompanying information meet the 	<p>MOD-026-2, Requirement R8 retains the intent of the old requirement. The new requirement specifies the Transmission Planner to review the model and accompanying information submitted. The new requirement adds the option of either notification of acceptance or notification of denial. The new requirement also points to the acceptance criteria, which are defined by the Transmission Planner in Requirement R1, Part 1.3. See Technical Rationale for more information.</p>

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<p>initializes to compute modeling data without error,</p> <p>6.2. A no-disturbance simulation results in negligible transients, and</p> <p>6.3. For an otherwise stable simulation, a disturbance simulation results in the excitation control and plant volt/var control function model exhibiting positive damping.</p> <p>If the model is not usable, the Transmission Planner shall provide a technical description of why the model is not usable. <i>[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]</i></p>	<p>acceptance criteria established in Requirement R1, or</p> <ul style="list-style-type: none"> 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. <p>MOD-026-2, Requirement R1, Part 1.3</p> <p>1.3. Acceptance criteria used by the Transmission Planner to determine disposition in Requirement R8 including, at a minimum, the following:</p> <p>1.3.1. model parameterization checks;</p> <p>1.3.2. model usability, initialization, and interoperability; and</p> <p>1.3.3. model submittal requirements.</p>	

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<p>MOD-027-1, Requirement R1</p> <p>R1. Each Transmission Planner shall provide the following requested information to the Generator Owner within 90 calendar days of receiving a written request: <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> • Instructions on how to obtain the list of turbine/governor and load control or active power/frequency control system models that are acceptable to the Transmission Planner for use in dynamic simulation, • Instructions on how to obtain the dynamic turbine/governor and load control or active power/frequency control function model library block diagrams and/or data sheets for models that are acceptable to the Transmission Planner, or • Model data for any of the Generator Owner’s existing applicable unit specific turbine/governor and load control or active power/frequency control system contained in the Transmission Planner’s 	<p>MOD-026-2, Requirement R1</p> <p>R1. 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: <i>[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]</i></p> <ol style="list-style-type: none"> 1.1. Acceptable positive sequence dynamic models, format, and level of detail for Facilities specifically identified within Requirement R2–R5; 1.2. Acceptable electromagnetic transient (EMT) models, format, and level of detail for Facilities specifically identified within Requirement R6; 1.3. Acceptance criteria used by the Transmission Planner to determine disposition under Requirement R8 including, at a minimum, the following: <ol style="list-style-type: none"> 1.3.1. model parameterization checks; 	<p>MOD-026-2, Requirement R1 retains the intent old requirement. The new requirement involves the Transmission Planner taking proactive action. The Planning Coordinator becomes jointly involved in the defining the acceptable model requirements and processes. Acceptable EMT models and format are added to the requirement. The Transmission Planner defines acceptance criteria, which would be used to determine whether the model is acceptable and usable from their perspective. See Technical Rationale for additional information.</p>

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dynamic database from the current (in-use) models.	<p>1.3.2. model usability, initialization, and interoperability; and</p> <p>1.3.3. model submittal requirements.</p> <p>1.4. Process for Generator Owner or Transmission Owner to provide verified models to the Transmission Planner;</p> <p>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</p> <p>1.6. Process for Generator Owner or Transmission Owner to obtain model data from the Transmission Planner’s database for an existing Facility owned by the Generator Owner or Transmission Owner within 90 calendar days of receiving a written request.</p>	
<p>MOD-027-1, Requirement R2</p> <p>R2. Each Generator Owner shall provide, for each applicable unit, a verified turbine/governor and load control or active power/frequency control model, including documentation and data (as specified in Part 2.1) to its Transmission Planner in accordance with the periodicity specified in MOD-027 Attachment</p>	<p>MOD-027-1, Requirement R2 (synchronous generation) is addressed by MOD-026-2 Requirement R3 and Requirement R5 (IBR)</p> <p>MOD-026-2 Requirement R3</p> <p>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,</p>	<p>The old requirement is separated into two requirements based on the type of Facility being modeled. The technology specific requirement language for synchronous and IBR units is updated for each respective requirement. New language is added, so the model and associated parameters must represent in-service equipment of the Facility. The verified model must include</p>

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<p>1. <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>2.1. Each applicable unit’s model shall be verified by the Generator Owner using one or more models acceptable to the Transmission Planner. Verification for individual units rated less than 20 MVA (gross nameplate rating) in a generating plant (per Section 4.2.1.2, 4.2.2.2, or 4.2.3.2) may be performed using either individual unit or aggregate unit model(s) or both. Each verification shall include the following:</p> <p>2.1.1. Documentation comparing the applicable unit’s MW model response to the recorded MW response for either:</p> <ul style="list-style-type: none"> • A frequency excursion from a system disturbance that meets MOD-027 Attachment 1 Note 1 with the applicable unit on-line, • A speed governor reference change with the applicable unit on-line, or • A partial load rejection test,^[2] 	<p>and accompanying information that represent the in-service equipment of the Facility to its Transmission Planner, within the timeframe in MOD-026-2 Attachment 1. The verified model(s) and accompanying information shall include at a minimum the following: <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>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;</p> <p>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;</p> <p>3.3. Model(s) representing enabled Protection Systems that trip the prime mover or generator either directly or via lockout or auxiliary tripping relays. Protection Systems that shall be modeled include over- and under-frequency elements. In addition, model(s) representing enabled prime</p>	<p>enabled protection systems. See Technical Rationale for additional information.</p>

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<p>2.1.2. Type of governor and load control or active power control/frequency control^[3] equipment,</p> <p>2.1.3. A description of the turbine (e.g. for hydro turbine - Kaplan, Francis, or Pelton; for steam turbine - boiler type, normal fuel type, and turbine type; for gas turbine - the type and manufacturer; for variable energy plant - type and manufacturer),</p> <p>2.1.4. Model structure and data for turbine/governor and load control or active power/frequency control, and</p> <p>2.1.5. Representation of the real power response effects of outer loop controls (such as operator set point controls, and load control but excluding AGC control) that would override the governor response (including blocked or nonfunctioning governors or modes of operation that limit Frequency Response), if applicable.</p>	<p>move over- and under-speed trip functions that directly trip the prime mover/generator; and</p> <p>3.4. Validation of the positive sequence dynamic model(s) of Part 3.2 response using the recorded response of 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.</p> <p>MOD-026-2 Requirement R5</p> <p>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 asset owner (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, within the timeframe in MOD-026-2 Attachment 1. The verified model(s) shall include at a minimum the following: <i>[Violation Risk Factor: Medium]</i> <i>[Time Horizon: Long-term Planning]</i></p>	

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	<p>5.1. Manufacturer, model number, and software/firmware version number of the IBR unit(s), and power plant controller;</p> <p>5.2. Model(s) representing the IBR unit(s) and associated active power/frequency control including the IBR unit’s electrical control, the Facility’s power plant controller, and other equipment which impacts Facility active power or grid frequency dynamic response;</p> <p>5.3. Model(s) representing enabled protections and limiting functions, that either directly trip IBR unit(s) or Facility, or limit active/reactive output of the IBR unit or Facility; and</p> <p>5.4. Validation of the positive sequence dynamic model of Part 5.2 response using the recorded response of 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.</p>	

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<p>MOD-027-1, Requirement R3</p> <p>R3. Each Generator Owner shall provide a written response to its Transmission Planner within 90 calendar days of receiving one of the following items for an applicable unit.</p> <ul style="list-style-type: none"> • Written notification, from its Transmission Planner (in accordance with Requirement R5) that the turbine/governor and load control or active power/frequency control model is not “usable,” • Written comments from its Transmission Planner identifying technical concerns with the verification documentation related to the turbine/governor and load control or active power/frequency control model, or • Written comments and supporting evidence from its Transmission Planner indicating that the simulated turbine/governor and load control or active power/frequency control response did not approximate the recorded response for three or more transmission system events. <p>The written response shall contain either the technical basis for maintaining the current</p>	<p>MOD-026-2, Requirement R9</p> <p>R9. Each Generator Owner or Transmission Owner shall provide a written response to its Transmission Planner after 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, within the timeframe in MOD-026-2 Attachment 1. The written response shall contain one of the following: <i>[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> • An updated verified model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, • A plan to verify the model in accordance with Requirements R2, R3, R4, R5, or R6, or • A resubmission of the current model and accompanying information in accordance with Requirements R2, R3, R4, R5, or R6, with additional technical justification and supporting evidence to address the notification of denial or model review from the Transmission Planner. 	<p>MOD-026-2, Requirement R9 retains the intent and most content of the old requirement. The requirement language is updated as needed based on the changes made to the other requirements. The reasons for a notification of denial from Transmission Planner are outlined in MOD-026-2 Requirement R8. See Technical Rationale for more information.</p>

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model, the model changes, or a plan to perform model verification (in accordance with Requirement R2). <i>[Violation Risk Factor: Lower]</i> <i>[Time Horizon: Operations Planning]</i>		
<p>MOD-027-1, Requirement R4</p> <p>R4. Each Generator Owner shall provide revised model data or plans to perform model verification^[5] (in accordance with Requirement R2) for an applicable unit to its Transmission Planner within 180 calendar days of making changes to the turbine/governor and load control or active power/frequency control system that alter the equipment response characteristic^[6] <i>[Violation Risk Factor: Lower]</i> <i>[Time Horizon: Operations Planning]</i></p>	<p>MOD-026-2, Requirement R7</p> <p>R8. Each Generator Owner or Transmission Owner, upon 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 its dynamic response characteristic(s),¹³ shall provide its Transmission Planner one of the following, within the timeframe in MOD-026-2 Attachment 1. <i>[Violation Risk Factor: Lower]</i> <i>[Time Horizon: Operations Planning]</i></p> <ul style="list-style-type: none"> • An updated verified model(s) in accordance with each Requirement R2, R3, R4, R5, or R6 applicable to the change being made, or • A plan to verify the model(s) in accordance with Requirement R2, R3, R4, R5, or R6. <p>Footnote 13: Such changes include: (a) exciter, voltage regulator, plant volt/var, power system stabilizer, or governor control replacement including software alterations; (b) addition or replacement of protection</p>	<p>MOD-026-2, Requirement R7 retains the intent of the old requirement. The new requirement refers to the in-service equipment outlined in Requirements R2–R6, and footnote 13 specifies the type of changes that are included.</p>

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	<p>systems that deploy under- and over- voltage and/or under- and over- frequency elements; (c) plant digital control system addition or replacement; (d) plant volt/var function equipment addition or replacement (such as static var systems, capacitor banks, individual unit excitation systems, or other equipment); (e) software, firmware or setting change in the equipment (such as exciter, voltage regulator, power system stabilizer, excitation limiter, governor, plant controller, FACTs devices or IBR unit, or other equipment.) that alters its dynamic response characteristics; (f) a permanent change in the voltage or frequency control mode (such as manually switching the voltage regulator from power factor control to automatic voltage control); or (g) any other equipment change that alters its dynamic response characteristic. Automatic change of control mode or a control setting that is implemented in the plant control systems are excluded.</p>	
<p>MOD-027-1, Requirement R5</p> <p>R5. Each Transmission Planner shall provide a written response to the Generator Owner within 90 calendar days of receiving the turbine/governor and load control or active power/frequency control system verified model information in accordance with Requirement R2 that the model is usable (meets the criteria specified in Parts 5.1 through 5.3) or is not usable.</p>	<p>MOD-026-2, Requirement R8</p> <p>R8. Each Transmission Planner shall review the model(s) and accompanying information submitted under Requirement R2–R7 or R9, and provide written response to the submitter after receiving each submission, within the timeframe in MOD-026-2 Attachment 1. The written response shall include one of the following: [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]</p>	<p>MOD-026-2, Requirement R8 retains the intent of the old requirement. The new requirement specifies the Transmission Planner to review the model and accompanying information submitted. The new requirement adds the option of either notification of acceptance or notification of denial. The new requirement also points to the acceptance criteria, which are defined by the Transmission Planner in Requirement R1. See Technical Rationale for more information.</p>

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<p>5.1. The turbine/governor and load control or active power/frequency control function model initializes to compute modeling data without error,</p> <p>5.2. A no-disturbance simulation results in negligible transients, and</p> <p>5.3. For an otherwise stable simulation, a disturbance simulation results in the turbine/governor and load control or active power/frequency control model exhibiting positive damping.</p> <p>If the model is not usable, the Transmission Planner shall provide a technical description of why the model is not usable. <i>[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]</i></p>	<ul style="list-style-type: none"> 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. <p>MOD-026-2, Requirement R1, Part 1.3</p> <p>1.3. Acceptance criteria used by the Transmission Planner to determine disposition in Requirement R7 including, at a minimum, the following:</p> <ul style="list-style-type: none"> 1.3.1. model parameterization checks; 1.3.2. model usability, initialization, and interoperability; and 1.3.3. model submittal requirements. 	