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1.0 PURPOSE

1.1 This standard defines responsibilities and requirements to meet certain requirements established by NERC Standards, MOD-025, “Verification and Data Reporting of Generator Real and Reactive Power Capability and Synchronous Condenser Reactive Power Capability”, MOD-026, “Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions”, MOD-027, “ Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions”, and MOD-032 “Data for Power System Modeling and Analysis”. This standard ensures Energy Supply provides generator steady state and dynamic modeling design data to the Transmission Planners as required.

2.0 APPLICABILITY

2.1 This standard is applicable to all Energy Supply generating facilities including hydro units and synchronous condensers included in the definition of Bulk Electric System.

The following additional qualifiers are applicable to MOD-026 and MOD-027:


- 2.1.1 In the WECC region, MOD-026 and MOD-027 are applicable to generating or synchronous condenser units >75 MVA and facilities with aggregate rating >75 MVA.
- 2.1.2 In the MRO and SPP regions, MOD-026 and MOD-027 are applicable to generating or synchronous condenser units >100 MVA and facilities with aggregate ratings >100 MVA.

3.0 RESPONSIBILITIES

- 3.1 The cognizant Reliability Engineer, and/or Project Manager/Engineer are responsible to:
 - 3.1.1 Notify Fleet Engineering of any proposed modifications to, or new installations of, excitation control system or plant volt/var control function equipment for applicable units. With Fleet Engineering guidance, provide Fleet Engineering with the verified model, documentation, and data for the new or modified excitation control system or plant volt/var control function equipment installed. Data shall be provided within 335 days after the facility being released for Commercial Operation.

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- 3.1.2 Notify Fleet Engineering of any proposed modifications to, or new installations of, turbine/governor and load control or active power/frequency control equipment for applicable units. With Fleet Engineering guidance, provide Fleet Engineering with the verified model, documentation, and data for the new or modified turbine/governor and load control or active power/frequency control equipment installed. Data shall be provided within 335 days after the facility being released for Commercial Operation.
- 3.1.3 Notify Fleet Engineering of any changes in generator steady state net real or reactive power design ratings, or any changes in design dynamic characteristics resulting from alterations of generator excitation or turbine governor equipment. This notification should be made at least 3 months prior to project installation.
- 3.2 Reliability Engineering is responsible to provide support to Fleet Engineering in coordinating and performance of testing required to verify modeling of applicable units or facilities.
- 3.3 Plant Directors or designee are responsible to notify Fleet Engineering when they become aware of any changes in generator steady state net real or reactive power design ratings. Furthermore, any changes in design dynamic characteristics resulting from alterations of generator excitation or turbine governor equipment or control functions that alter the equipment response characteristic.
- 3.4 Analytics and Practices is responsible to:
 - 3.4.1 Verify and provide Fleet Engineering with Real Power capability of applicable units or facilities within 30 days after verification, as requested during data gathering for Green & White Capacity Ratings.
- 3.5 Fleet Engineering personnel are responsible to:
 - 3.5.1 Provide overall compliance guidance and support as needed to execute activities and verify timely completion.
 - 3.5.2 Maintain information, provide information upon request, and communicate changes of that Operating Company's power plant steady state and dynamic modeling data to the regional Transmission Planning organization. This information will be maintained and promulgated per the region-specific processes described in Section 4.0 below.

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3.5.2.1 Evidence of correspondence with Transmission Planning concerning steady state and dynamic modeling data shall be stored in the appropriate MOD-032 Documentum folder.

3.5.3 Verify and provide the Transmission Planner with Real and Reactive Power capability of applicable units or facilities.

3.5.3.1 Evidence of correspondence with Transmission Planning concerning Real and Reactive Power capability shall be stored in the appropriate MOD-025 Documentum folder.

3.5.4 Verify and provide the Transmission Planner with the generator excitation control system or plant volt/var control function model, including documentation and data for each applicable unit or facility.

3.5.4.1 Evidence of correspondence with Transmission Planning concerning generator excitation control system or plant volt/var control function modeling shall be stored in the appropriate MOD-026 Documentum folder.

3.5.5 Verify and provide the Transmission Planner with the turbine/governor and load control or active power/frequency control model, including documentation and data for each applicable unit or facility.

3.5.5.1 Evidence of correspondence with Transmission Planning concerning the turbine/governor and load control or active power/frequency control modeling shall be stored in the appropriate MOD-027 Documentum folder.

4.0 REQUIREMENTS:


4.1 Regional Performance Optimization personnel shall fulfill their MOD-032 responsibilities as follows:

4.1.1 Northern States Power (NSP), Southwestern Public Service (SPS), Public Service Company of Colorado (PSCO):

4.1.1.1 Fleet Engineering shall maintain a database of generator steady state modeling design data including minimum and maximum net real and reactive power ratings. This database shall be maintained in Documentum and provided to Transmission Planning upon request or when changes are made.

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4.1.1.2 Fleet Engineering shall maintain a database of generator design modeling design data. This database shall be maintained in Documentum and provided to Transmission Planning upon request or when changes are made.

4.1.1.3 Fleet Engineering personnel shall provide steady-state, dynamic, and short circuit modeling data to its Transmission Planner and Planning Coordinator (PSCO) or to its Transmission Planner (NSP and SPS) according to their modeling data requirements and reporting procedures. The Xcel Energy Transmission Planner for NSP and SPS submits the modeling data to the Planning Coordinator on behalf of the Generator Owner. For data that has not changed, an email notification confirming the data has not changed is sufficient. Email notifications will be maintained in Documentum.

Data submission schedule in the regions are as follows:

- NSP provides data to Transmission Planner when changes occur.
- PSCO provides data annually.
- SPS provides annual update when data is requested.


Energy Supply supplies the modeling data to the Transmission business area. Transmission submits the final Generator Owner and Transmission Owner data in the correct format to the Planning Coordinator. Transmission fulfils any time-based reporting requirements in the Transmission Planner & Planning Coordinator data reporting procedures.

4.1.1.4 Upon written notification from the Planning Coordinator or Transmission Planner regarding technical concerns with data submitted above, Fleet Engineering will:

- 4.1.1.4.1 Provided either updated data or an explanation with a technical basis for maintaining the current data.
- 4.1.1.4.2 Provide the response within 90 calendar days after receipt unless a longer time period is agreed upon by the notifying Planning Coordinator or Transmission Planner.
- 4.1.1.4.3 Evidence or correspondence will be maintained in Documentum. If no written notification(s) received, a

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statement that it has not received written notification regarding technical concerns with the data submitted may be posted to Documentum as evidence.

- 4.1.1.5 In the NSP region only, the NSP Transmission Planner works with Generator Owner, Resource Planner, and Transmission Owner to resolve any technical concerns with data submitted to either Planning Coordinator or Transmission Planner. NSP Transmission Planner will provide a response to Planning Coordinator within 90 days after receipt that either updated data, or an explanation with a technical basis to keep the data as originally submitted. NSP Transmission Planner will retain the necessary evidence of its responses and provide Energy Supply with access to evidence.
- 4.2 Performance Optimization Analytics and Practices, Fleet Engineering personnel shall fulfill their MOD-025 responsibilities as follows (Reference Appendix A):
 - 4.2.1 Analytics and Practices shall, when requested during Green & White Sheet Capacity Ratings, verify the Real Power capability of each applicable units or facility in accordance with Attachment 1 of MOD-025. Analytics and Practices shall provide Fleet Engineering a completed Attachment 2 of MOD-025 or a form containing the same information as identified in Attachment 2, within 30 calendar days after either (i) the date the data is recorded for a staged test; or (ii) the date the data is selected for verification using historical operational data.
 - 4.2.2 Fleet Engineering shall verify the Real and Reactive Power capability of each applicable units or facility in accordance with Attachment 1 of MOD-025. Fleet Engineering shall provide the Transmission Planner a completed Attachment 2 of MOD-025 or a form containing the same information as identified in Attachment 2, within 90 calendar days after either (i) the date the data is recorded for a staged test; or (ii) the date the data is selected for verification using historical operational data.
- 4.3 Performance Optimization, Fleet Engineering personnel shall fulfill their MOD-026 responsibilities as follows (Reference Appendix B – note for all Facilities that meet MOD-026 applicability, a written notification to the Transmission Planner SHALL be made.):
 - 4.3.1 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 4.5.1.1 to the Transmission Planner in accordance with the periodicity specified in MOD-026 Attachment 1.

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- 4.3.1.1 Each applicable unit’s model shall be verified using one or more models acceptable to the Transmission Planner. Each verification shall include the following:
 - 4.3.1.1.1 Documentation demonstrating the applicable unit’s model response matches the recorded response for a voltage excursion from either a staged test or a measured system disturbance.
 - 4.3.1.1.2 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).
 - 4.3.1.1.3 Model structure and data including, but not limited to reactance, time constants, saturation factors, total rotational inertia, or equivalent data for the generator.
 - 4.3.1.1.4 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.
 - 4.3.1.1.5 Compensation settings (such as droop, line drop, differential compensation), if used.
 - 4.3.1.1.6 Model structure and data for power system stabilizer, if so equipped.
 - 4.3.1.1.7 For newly constructed or purchased wind and solar Facilities, it is recommended to model Voltage Control, Power Factor Control, and VAR control operating modes to avoid future remodeling if Operations changes modes.
- 4.3.2 Shall provide a written response to the Transmission Planner within 90 calendar days after receiving one of the following items for an applicable unit:
 - 4.3.2.1 Written notification from the Transmission Planner (in accordance with MOD-026, R6) that the excitation control system or plant volt/var control function model is not usable.

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- 4.3.2.2 Written comments from the Transmission Planner identifying technical concerns with the verification documentation related to the excitation control system or plant volt/var control function model.
- 4.3.2.3 Written comments and supporting evidence from the 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.

The written response shall contain either the technical basis for maintaining the current model, the model changes, or a plan to perform model verification.

- 4.3.3 Shall provide revised model data or plans to perform model verification (in accordance with MOD-026, R2) for an applicable unit to the Transmission Planner within 180 calendar days after making changes to the excitation control system or plant volt/var control function that alter the equipment response characteristic.
- 4.3.4 Shall provide a written response to the Transmission Planner, within 90 calendar days following receipt of a technically justified unit request from the Transmission Planner to perform a model review of a unit or plant that includes one of the following:
 - 4.3.4.1 Details of plans to verify the model (in accordance with MOD-026, R2).
 - 4.3.4.2 Corrected model data including the source of revised model data such as discovery of manufacturer test values to replace generic model data or updating of data parameters based on an on-site review of the equipment.
- 4.3.5 Fleet Engineering personnel or their delegate shall create a reminder in eGRC for applicable due date for model verifications or equipment modifications.
- 4.4 Energy Supply Project’s personnel shall fulfill their MOD-026 responsibilities as identified in XES 7.400 and XES 7.405 (Reference Appendix B).
- 4.5 Performance Optimization, Fleet Engineering personnel shall fulfill their MOD-027 responsibilities as follows (Reference Appendix C – note for all Facilities that meet MOD-027 applicability, a written notification to the Transmission Planner SHALL be made.):

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- 4.5.1 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 section 4.6.1.1 to the Transmission Planner in accordance with the periodicity specified in MOD-027 Attachment 1.
 - 4.5.1.1 Each applicable unit’s model shall be verified using one or more models acceptable to the Transmission Planner. Each verification shall include the following:
 - 4.5.1.2 Documentation comparing the applicable unit’s MW model response to the recorded MW response for either:
 - 4.5.1.2.1 A frequency excursion from a system disturbance that meets MOD-027 Attachment 1 Note 1 with the applicable unit on-line.
 - 4.5.1.2.2 A speed governor reference change with the applicable unit on-line.
 - 4.5.1.2.3 A partial load rejection test.
 - 4.5.1.3 Type of governor and load control or active power control/frequency control equipment.
 - 4.5.1.4 A description of the turbine.
 - 4.5.1.5 Model structure and data for turbine/governor and load control or active power/frequency control.
 - 4.5.1.6 Representation of the real power response effects of outer loop controls that would override the governor response if applicable.
 - 4.5.1.7 For newly constructed or purchased wind and solar Facilities, it is recommended to model operating mode as if enabled, regardless of initial operating modes, to avoid future remodeling if Operations changes modes.
- 4.5.2 Shall provide a written response to the Transmission Planner within 90 calendar days after receiving one of the following items for an applicable unit.
 - 4.5.2.1 Written notification from the Transmission Planner (in accordance with MOD-027, R5) that the turbine/governor and load control or active power/frequency control model is not usable.

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4.5.2.2 Written comments from the Transmission Planner identifying technical concerns with the verification documentation related to the turbine/governor and load control or active power/frequency control model.

4.5.2.3 Written comments and supporting evidence from the 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.

The written response shall contain either the technical basis for maintaining the current model, the model changes, or a plan to perform model verification (in accordance with MOD-027, R2).

4.5.3 Shall provide revised model data or plans to perform model verification (in accordance with MOD-027, R2) for an applicable unit to the Transmission Planner within 180 calendar days after making changes to the turbine/governor and load control or active power/frequency control system that alter the equipment response characteristic.

4.5.3.1 Changes to items below alter the equipment response characteristic and require 180 calendar days model verification to the Transmission Planner:

4.5.3.1.1 Droop

4.5.3.1.2 Dead band


4.5.3.1.3 Frequency Control Modes: Including changing between Isochronous and Droop Control, changes to any outer loop control contributing to droop response, or disabling/enabling any logic or algorithms contributing to droop response.

4.5.3.2 Fleet Engineering Controls personnel making changes to the control systems that alter frequency response shall coordinate those changes and notifications with Fleet Engineering Electrical personnel.

4.5.4 Fleet Engineering personnel or their delegate shall create a reminder in eGRC for applicable due date for model verifications or equipment modifications.

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4.6 Energy Supply Project’s personnel shall fulfill their MOD-027 responsibilities as identified in XES 7.400 and XES 7.405 (Reference Appendix C).

5.0 REQUIRED RECORDS

5.1 Fleet Engineering shall maintain evidence of correspondence with Transmission Planning documenting:

- 5.1.1 Modeling data was provided in response to requests and that Transmission Planning was notified of changes in any steady state or dynamic modeling data.
- 5.1.2 Real and reactive power verification was provided.
- 5.1.3 A verified generator excitation control system or plant volt/var control function model, including documentation and data was provided.
- 5.1.4 A verified turbine/governor and load control or active power/frequency control model, including documentation and data was provided.

6.0 REFERENCES AND DEFINITIONS

6.1 References


- 6.1.1 Glossary of Terms Used in NERC Reliability Standards
- 6.1.2 XES 7.405, Screening of Projects for Impact on NERC Compliance Program (found on the [Energy Supply Policies web page](#))
- 6.1.3 XES 7.400, NERC FAC-002 Coordination of Plans for New Facilities (found on the [Energy Supply Policies web page](#))

6.2 Definitions

- 6.2.1 North American Electric Reliability Corporation (NERC) – The organization charged with establishing standards for the reliable operation of the North American electric power grids.
- 6.2.2 Bulk Electric System (BES) – See definition in Glossary of Terms Used in NERC Reliability Standards.
- 6.2.3 NERC Reliability Standard MOD-025 – NERC Standard applicable to the verification and data reporting of generator real and reactive power capability and synchronous condenser reactive power capability.

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- 6.2.4 NERC Reliability Standard MOD-026 – NERC Standard applicable to the verification of models and data for generator excitation control system or plant volt/var control functions.
- 6.2.5 NERC Reliability Standard MOD-027 – NERC Standard applicable to the verification of models and data for turbine/governor and load control or active power/frequency control functions.
- 6.2.6 NERC Reliability Standard MOD-032 – NERC Standard applicable to establishing consistent modeling data requirements and reporting.
- 6.2.7 Transmission Planner - The Transmission Planning role is performed by Xcel Energy for all fleet generation facilities in the MRO, WECC, and SPP service regions.

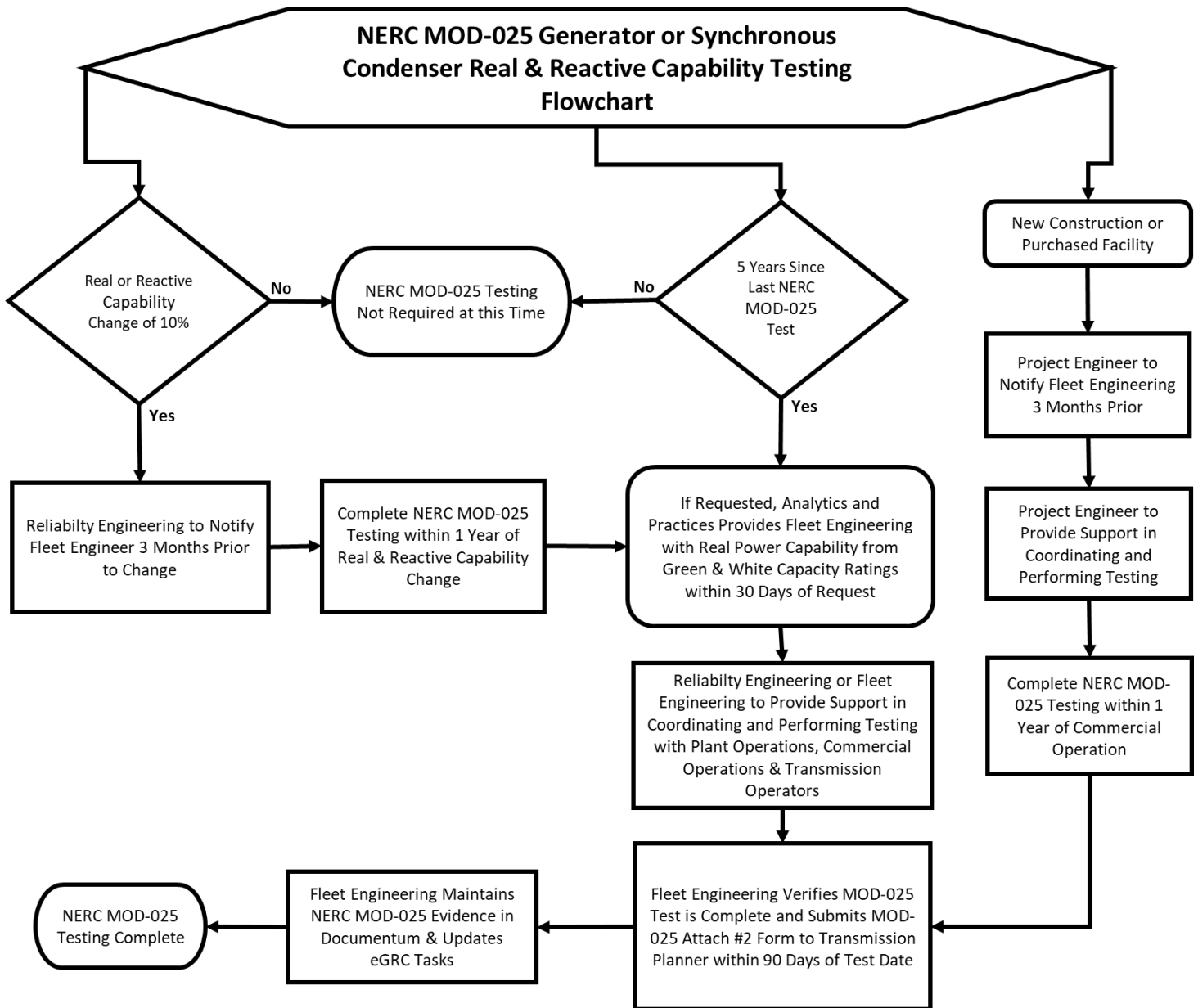
7.0 REVISION HISTORY

Date	Revision	Change
02/03/2014	1.0	Original Issue, supersedes XES 1.110 Rev 2.2 Stability Modeling Data Maintenance and Reporting Requirements
07/21/2014	2.0	Modified to include MOD-025, MOD-026 and MOD-027
11/22/2016	3.0	Modified to include MOD-032-1 and delete MOD-010 and MOD-012.
02/14/2019	4.0	Improved MOD-032 requirement section 4.1.
8/23/2022	5.0	Triennial Review along with department name changes, added Appendix flowcharts, and eGRC Reminder Tasks.
04/14/2023	6.0	Modified section 4.5.3 to clarify specific examples requiring MOD-027 revised modeling. Clarified reporting requirements to the Transmission Planner in section 4.3 and 4.5. Updated flow Appendix B and Appendix C Flowcharts. Added modeling recommendation for wind and solar Facilities in sections 4.3.1.1.7 and 4.5.1.7.

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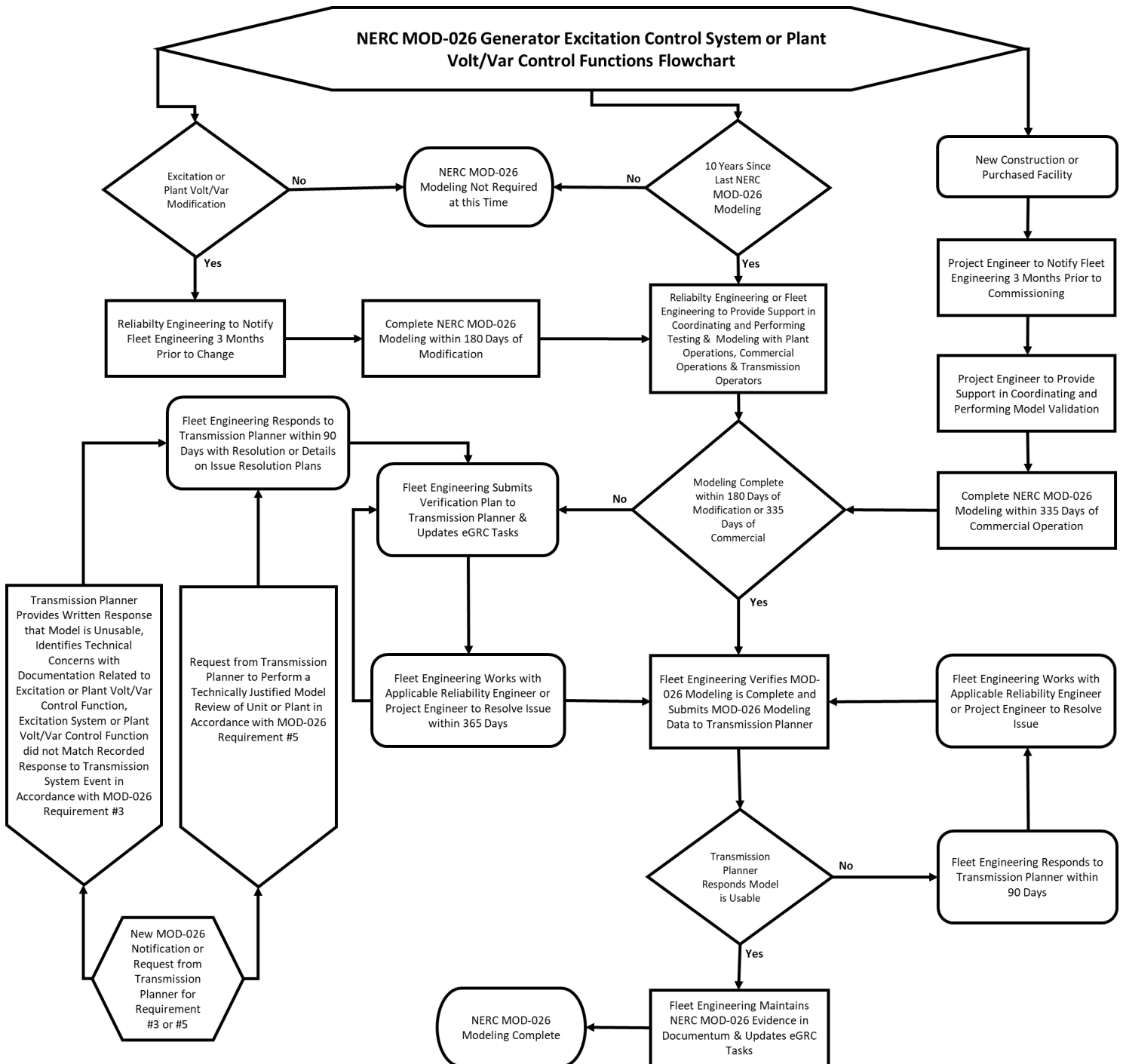
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Appendix A: NERC MOD-025 Flowchart



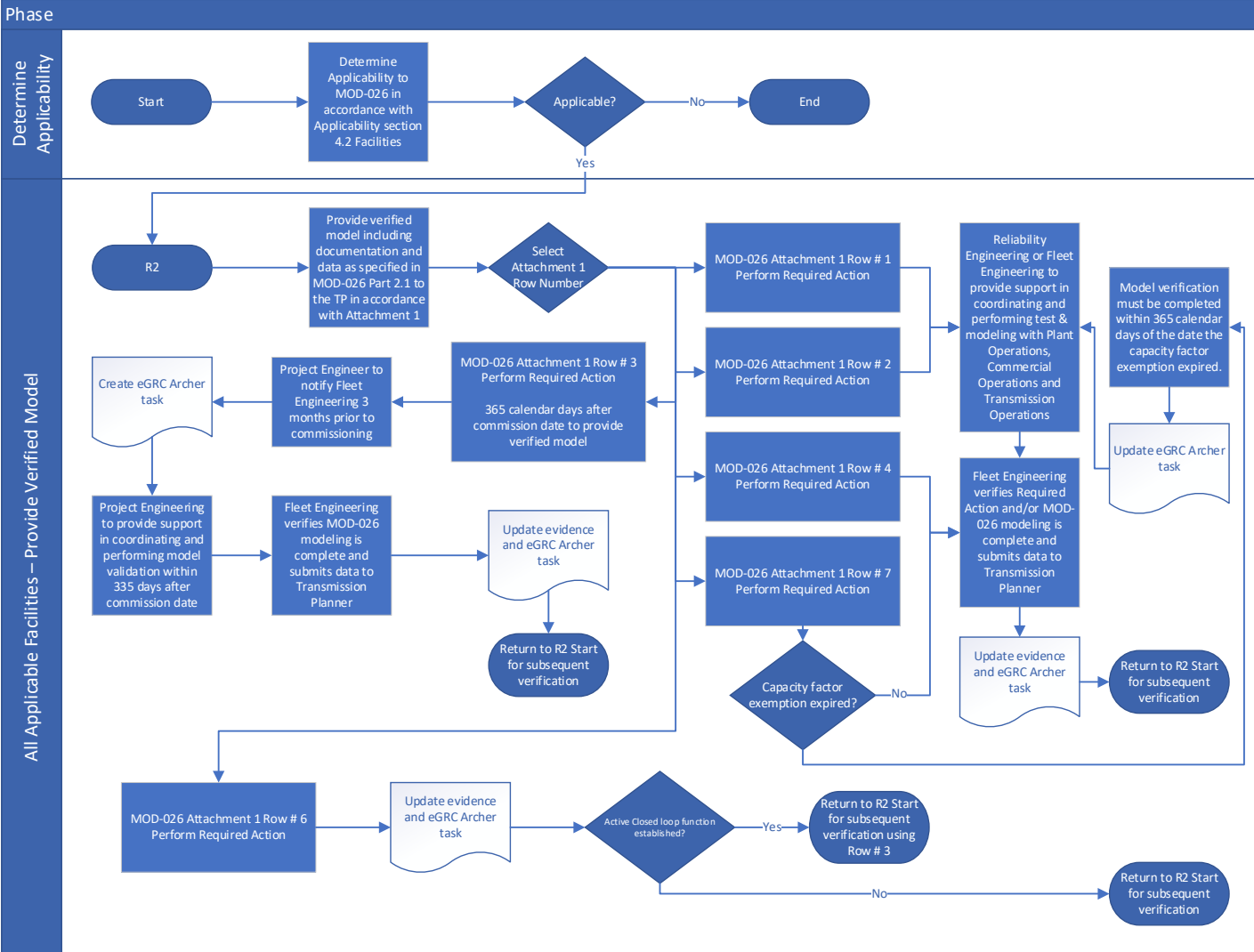
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Appendix B: NERC MOD-026 Flowcharts


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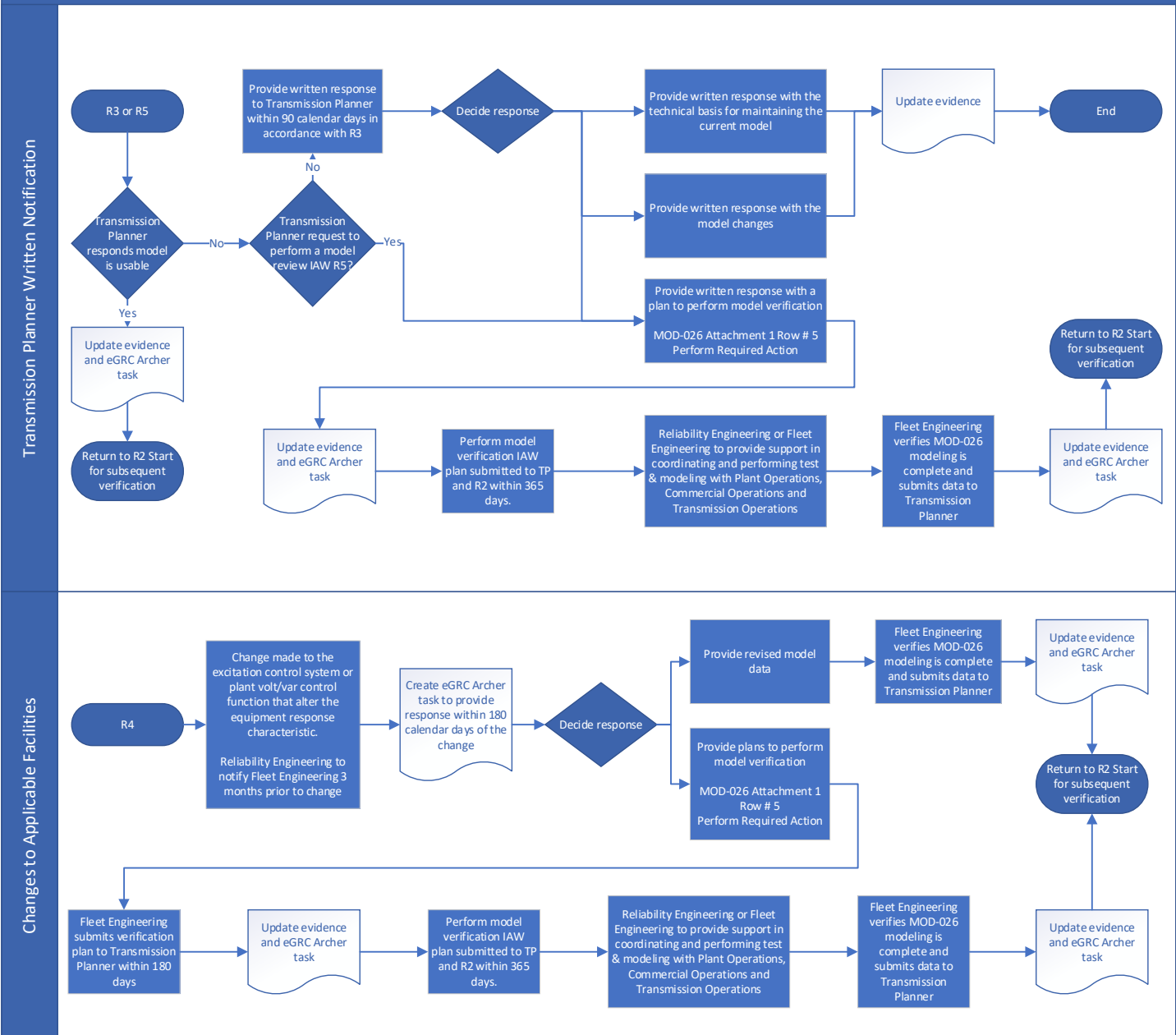
NERC MOD-026 Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions Flowchart – Part 1 of 2


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NERC MOD-026 Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions Flowchart – Part 2 of 2

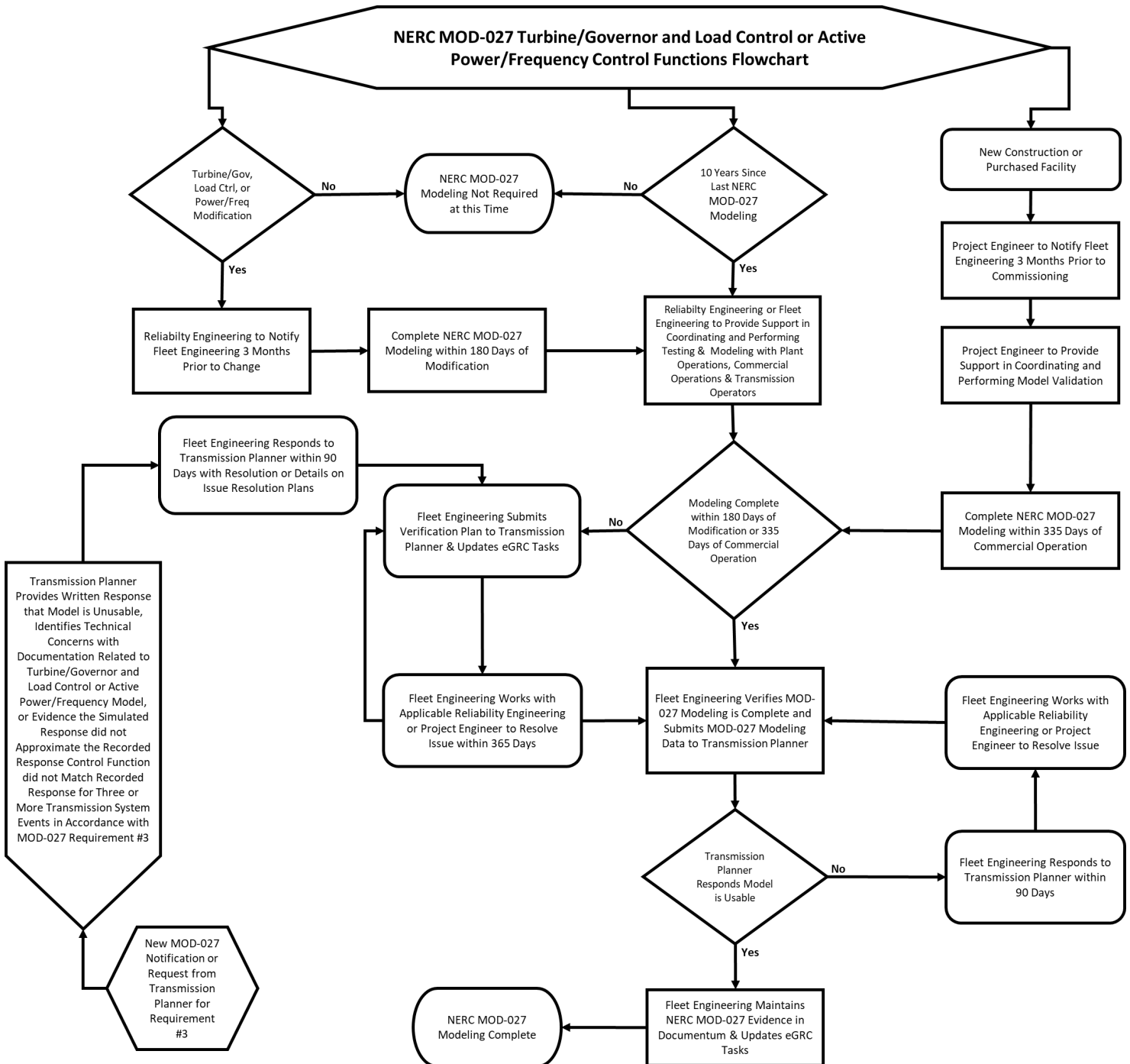
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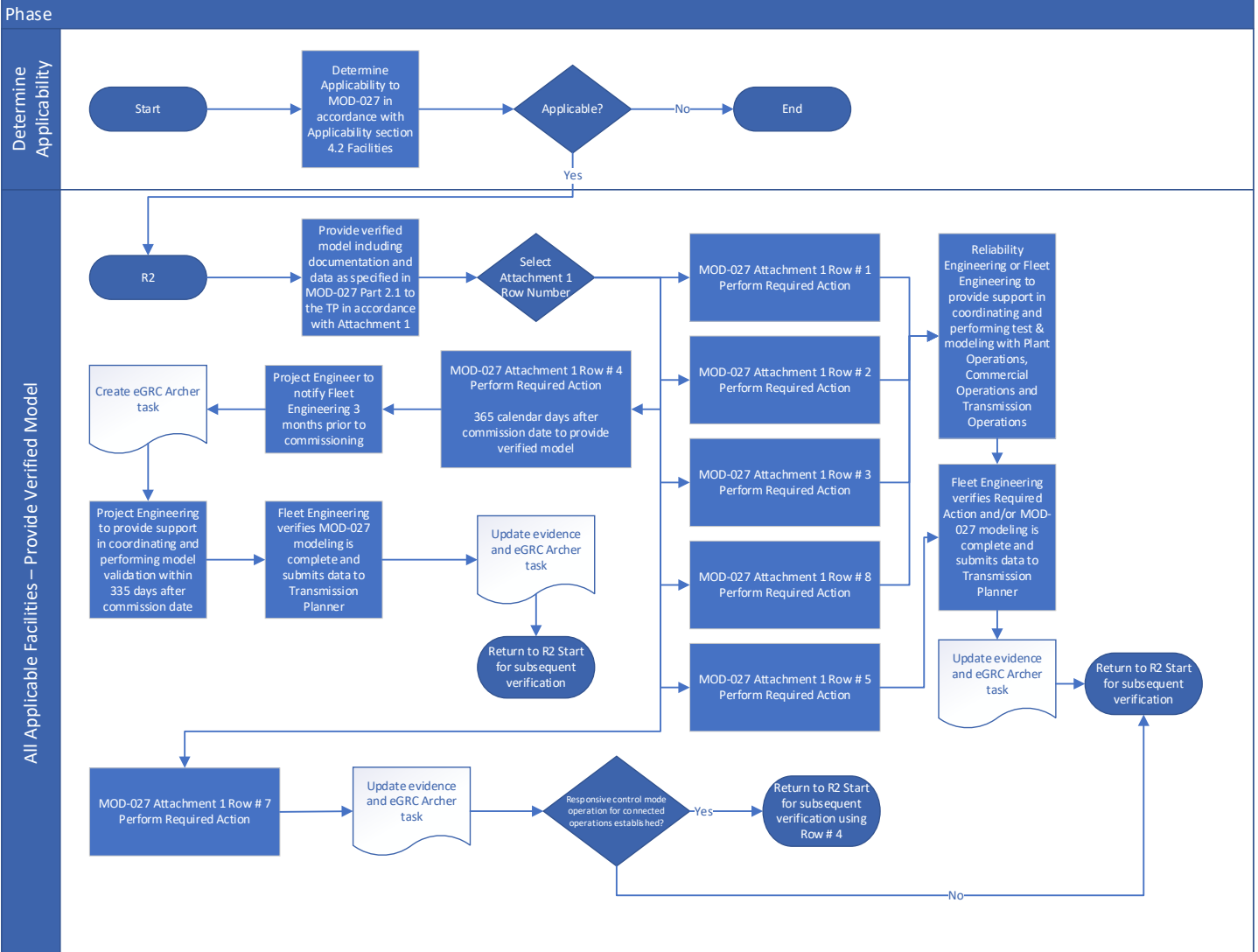
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Appendix C: NERC MOD-027 Flowcharts



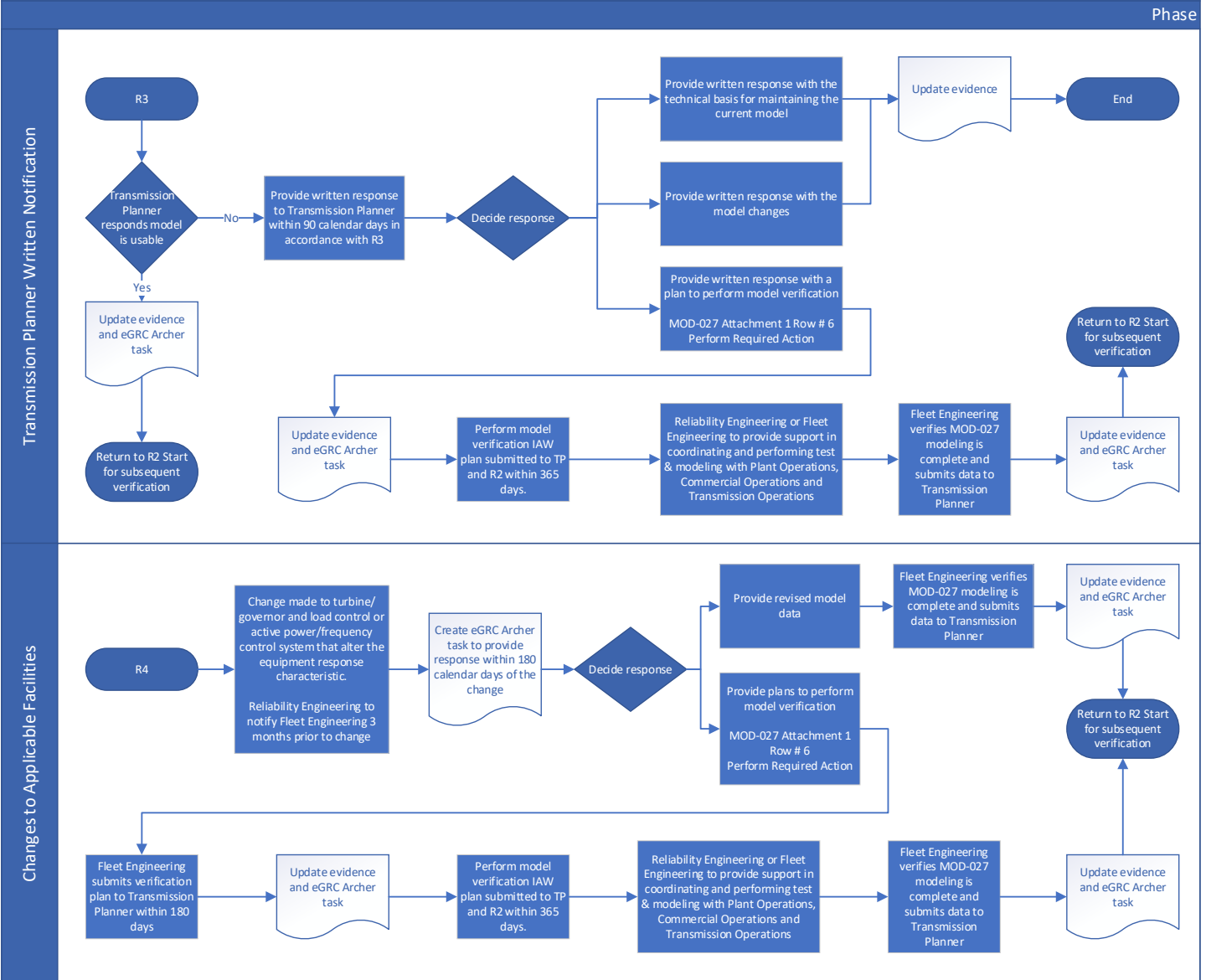
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NERC MOD-027 Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions Flowchart – Part 1 of 2


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NERC MOD-027 Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions Flowchart – Part 2 of 2


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