

Ensuring that a company remains in compliance with NERC requires significant investment in staffing, resources, and expertise that many companies may not have in house. At Ulteig, our engineers provide comprehensive compliance services to the full range of NERC registered entities. Meeting compliance requirements can include completing highly technical assessments/studies, which can also be a drain on the company's staffing resources. The NERC compliance requirements of a company are subject to change, as are filing deadlines. Keeping track of everything can also be complex and time consuming.

We offer NERC compliance services that include completing NERC compliance assessment/study, including monitoring updated requirements and tracking filing deadlines. Our goal is to allow our clients to focus on serving their customers and their assets while we fill the role of ensuring compliance with federal regulations.

The list of NERC standards below are the ones that Ulteig is typically requested to complete and require engineering and design. This is not the comprehensive list of NERC standards. If a company requires a full NERC compliance solution then Ulteig can discuss that with them. Ulteig performs the NERC compliance work during or after project design is complete. Ulteig can also do NERC compliance work on projects that Ulteig did not do the project design.

ULTEIG NERC COMPLIANCE: METHODOLOGY & DESIGN INPUTS

- **FAC-008-3** – Documentation will be provided showing the facility ratings of plant equipment as required by FAC-008-3. The documentation will show that the facility ratings do not exceed the most limiting applicable equipment rating in the plant.
» **Design Inputs:** Ratings for all equipment, final one-line drawings, equipment drawings, completed studies (reactive power and cable ampacity)
- **MOD-025-2** – Ulteig will provide a testing plan for determining the plant real and reactive power capabilities to satisfy the requirements of MOD-025. Ulteig will work with the client to carry out the tests on-site or remotely, depending on the client's preference, to verify the real and reactive power capabilities of the system by utilizing the developed test plan.
» **Design Inputs:** On-site testing results once complete
- **MOD-026-1** – Ulteig will provide a testing plan for recording the plant reactive power and voltage response to a system voltage deviation as described in MOD-026-1. Ulteig will work with the client to carry out the tests on-site to verify the generation excitation control system by utilizing the developed test plan, if desired. Testing will require One (1) to two (2) representatives from Ulteig on-site, with plant operators available for assistance as needed. After testing is completed, Ulteig will use an approved PSSE dynamic model of the plant to verify the response of the model accurately represents the real-time response during testing. The PSSE dynamic model will be developed in a format approved by the interconnecting utility, and is expected to require use of the standard PSSE library models. The MOD-026 Compliance Report will include a graph overlaying the actual response during the staged tests and the simulated response from the developed model. A draft report will be provided for review prior to providing the final version. The final version of the report will be sealed by an engineer licensed in the appropriate jurisdiction. Reports will be provided in electronic (PDF) format only.
» **Design Inputs:** On-site testing results once complete, PSSE dynamic models for all generators, plant design parameters (one-line drawings, transformer test reports, cable impedances, relay settings, etc.)

- **MOD-027-1** – Ulteig will provide a testing plan for recording the turbine active power and frequency response to a system frequency deviation as described in MOD-027-1. Ulteig will work with the client to carry out the tests on-site to verify the plant voltage/var control system by utilizing the developed test plan, if desired. Testing will require one (1) to two (2) representatives from Ulteig on-site, with plant operators available for assistance as needed. After testing is completed, Ulteig will use an approved PSSE dynamic model of the plant to verify the response of the model accurately represents the real-time response during testing. The PSSE dynamic model will be developed in a format approved by the interconnecting utility, and is expected to require use of the standard PSSE library models. The MOD-027 Compliance Report will include a graph overlaying the actual response during the staged tests and the simulated response from the developed model. A draft report will be provided for review prior to providing the final version. The final version of the report will be sealed by an engineer licensed in the appropriate jurisdiction. Reports will be provided in electronic (PDF) format only.
» Design Inputs: On-site testing results once complete, PSSE dynamic models for all generators, plant design parameters (one-line drawings, transformer test reports, cable impedances, relay settings, etc.)
- **PRC-001-1.1(ii)** – Ulteig will verify coordination with interconnecting utilities to ensure coordination between systems.
» Design Inputs: N/A – Utility coordination takes place during relay settings engineering design
- **PRC-004-5** – Ulteig will perform event analysis, determine root cause and corrective action plan.
» Design Inputs: N/A – An event must occur to trigger an analysis
- **PRC-005-6** – Ulteig can provide asset identification and testing requirements per the client's Protection System Maintenance Program (PSMP). We have experience working the plant environment and know how to determine which protective relays are applicable to the standard and which are not. Ulteig can also perform NERC required testing services. Ulteig can assist a client in developing a PSMP, if needed.
» Design Inputs: IFC Drawings, SCADA Points List
- **MOD-032-1** – Ulteig will provide a model of the project in PSSE v33 format containing the steady-state, dynamic, and/or short circuit information required by the interconnecting utility.
» Design Inputs: For preliminary version: PSSE dynamic models for all generators, plant design parameters (one-line drawings, transformer test reports, cable impedances, relay settings, etc.), specific MOD-032 requirements for operating region. For final version: completed MOD-026/027 reports
- **PRC-019-2** – Ulteig will develop a report to assess compliance with the NERC PRC-019-2 standard. A protection coordination analysis will be completed to assess that the in-service plant limiters will operate before the Protective Systems operate.

For conventional generation, Ulteig will assess whether generator excitation system limiter is coordinated with the generator capability curve and the associated generator Protection System. To demonstrate evidence of coordination of the Generator Protection System, a P-Q diagram showing the equipment capabilities and the operating region for the limiters and protection functions will be provided.

For renewable generation, Ulteig will assess whether any in-place limiters are coordinated with the generator or inverter Protection System and will also assess that the substation over/under voltage settings coordinate with the generator or inverter Protection System. To demonstrate the substation relays coordination with the generator or inverter Protection System, a graph showing the voltage protection settings, assuming a constant per-unit voltage throughout the system, will be provided. In some cases, a load flow analysis will be performed to demonstrate that there are no voltage issues created by the limits set in the automatic voltage regulator, this may be required depending on turbine/inverter type. Additionally, the report will demonstrate that the generator or inverter Protection System protects the capability curve of the generator or inverter.

Ulteig will provide a report detailing assumptions made during the analysis as well as the results and recommendations, if any, to meet the PRC-019-2 requirements. Once the results have been finalized, the study will be sealed by a Professional Engineer (PE) licensed in the appropriate jurisdiction.

» Design Inputs: WTG/Inverter Manufacturer Information, Relay Settings

- **PRC-023-4** – Ulteig will evaluate all load responsive elements to ensure they meet the NERC PRC-023-4 requirements.

» **Design Inputs:** *Relay Settings, Line Ratings*

- **PRC-024-2** – This study will evaluate the project’s ability to meet the NERC PRC-024-2 Generator Frequency and Voltage Protective Relay Settings at the project’s Point of Interconnection (POI). For conventional generation, this study will include the following:

Ulteig will use information on the project by the owner to complete hand calculations or simple software load flow calculations to determine the expected voltage at the generator, taking into consideration system voltage drop. Calculations will be performed under applicable system conditions, such as when the generator is supplying reactive power or absorbing reactive power. Calculations will be performed for each voltage on the voltage ride-through time duration curve in PRC-024-2 Attachment 2. Ulteig will assume the automatic voltage regulator (AVR) is not operating dynamically in order to assess compliance under conservative project conditions. Ulteig will assess the generator’s overvoltage and undervoltage protective relay settings and provide recommendations as needed to ensure they will not trip within the no trip zone required by the interconnecting utility and PRC-024-2. Ulteig will assess the generator’s overfrequency and underfrequency protective relay settings and provide recommendations as needed to ensure they will not trip within the no trip zone required by the interconnecting utility and PRC-024-2.

For renewable generation, a dynamic analysis and report will be completed on the wind or solar project using PSSE to verify the low-voltage ride-through, high-voltage ride-through, low-frequency ride-through, and high-frequency ride-through capabilities of the project meet the requirements of the interconnecting utility and NERC standards as shown in PRC-024-2.

Upon completion of the study, Ulteig will provide a report detailing assumptions made during the analysis as well as the results and recommendations, if any, to meet the voltage ride-through and frequency ride-through requirements of PRC-024-2. If the requirements cannot be met, the reasoning will be documented as necessary to meet the requirements of PRC-024-2. Once the results have been finalized, the study will be sealed by a Professional Engineer (PE) licensed in the appropriate jurisdiction.

» **Design Inputs:** *PSSE dynamic models for all generators, plant design parameters (one-line drawings, transformer test reports, cable impedances, relay settings, etc.)*

- **PRC-025-2** – Evaluate all load responsive protective elements for compliance with the PRC-025-2 standard. Ulteig will provide a report detailing assumptions made during the analysis as well as the results and recommendations, if any, to meet the PRC-025-2 requirements. For renewable generation, the report will include analysis all the way down to the individual generators/inverters. Once the results have been finalized, the study will be sealed by a Professional Engineer (PE) licensed in the appropriate jurisdiction.

» **Design Inputs:** *WTG/Inverter Manufacturer Information, Relay Settings, IFC One Lines*

- **PRC-026-1** – Ulteig will evaluate all load responsive elements to ensure they meet the NERC PRC-026-1 requirements.

» **Design Inputs:** *Relay Settings, Short Circuit Model*

- **PRC-027-1** - Ulteig will provide a coordination study demonstrating compliance with the PRC-027-1 standard.

» **Design Inputs:** *Relay Settings, Short Circuit Model*

- **TPL-007-1** – Ulteig will provide a testing plan for determining ground grid resistance and DC winding resistance of the transformers to satisfy the component requirements of the Geomagnetically-Induced Current (GIC) System model of TPL-007. Ulteig will work with the client to carry out the tests on-site to determine the measurements according to the developed test plan. Ground grid testing will generally require two (2) representatives from Ulteig on-site for half a day and would not require access inside the substation. If needed, transformer winding resistance testing will require an outage of the substation for a full day. After testing is complete, Ulteig can create the GIC system model as described in TPL-007 and perform the GIC flow for the transformer thermal impact assessment. Ulteig will develop a report to assess compliance with the NERC TPL-007 standard, and provide the GIC system model and the thermal impact of the transformers.