ISO NEW ENGLAND PLANNING PROCEDURE NO. 3

RELIABILITY STANDARDS FOR THE NEW ENGLAND AREA POOL TRANSMISSION FACILITIES

EFFECTIVE DATE: 04/12/2023

REFERENCES:

- NPCC Regional Reliability Reference Directory #1 Design and Operation of the Bulk Power System
- NPCC Regional Reliability Reference Directory #4 Bulk Power System Protection Criteria
- NPCC Glossary of Terms
- NPCC Regional Reliability Reference Directory #7 Remedial Action Schemes
- ISO New England Planning Procedure 5-5, Requirements and Guidelines for Application of Remedial Action Schemes and Automatic Control Schemes
- NERC TPL-001, Transmission System Planning Performance Requirements
- NERC NUC-001, Nuclear Plant Interface Coordination
- NERC Glossary of Terms Used in NERC Reliability Standards
- NERC PRC-012-2 Remedial Action Schemes
- Master/Local Control Center Procedure No. 1 - Nuclear Plant Transmission Operations

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RELIABILITY STANDARDS FOR THE NEW ENGLAND AREA POOL TRANSMISSION FACILITIES

1. INTRODUCTION

The purpose of these New England reliability standards is to assure the reliability of the New England Pool Transmission Facilities (PTF) through coordination of system planning, design and operation. These standards apply to all entities comprising or using the New England PTF. The host Market Participant or Transmission Owner (the Market Participant or Transmission Owner through which a non-Market Participant and non-Transmission Owner connects to the PTF) shall use its best efforts to assure that, whenever it enters into arrangements with non-Market Participants and non-Transmission Owners, such arrangements are consistent with these standards.

These reliability standards establish minimum design criteria for the New England PTF. In addition to these standards, the North American Electric Reliability Corporation (NERC) and the Northeast Power Coordinating Council (NPCC) also have design criteria which may also apply to portions of the New England PTF. NERC and NPCC design criteria may be more stringent than what is contained in these standards. Therefore, meeting the requirements set forth in this document does not assure that NERC and NPCC's criteria have also been met. Similarly, there may be instances that these standards are more stringent than the design criteria of NERC or NPCC and meeting the NERC or NPCC design criteria does not meet these standards.

The New England PTF is required to be designed to meet the performance requirements for representative contingencies as defined in these reliability standards. Analyses of these contingencies may include assessment of the potential for the inability to meet the Nuclear Plant Interface Requirements (NPIRs). The NPIRs for each nuclear plant generator subject to dispatch by ISO New England Inc. (ISO) are documented in the Attachment to Master/Local Control Center Procedure No. 1 - Nuclear Plant Transmission Operations (M/LCC 1) applicable to that nuclear plant generator.

The loss of minor portions of the transmission system may be tolerated provided the reliability of the overall interconnected transmission system is not jeopardized and the NPIRs are met.

2. SECTION 2

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3. PTF TRANSMISSION REQUIREMENTS

The New England PTF shall be designed with sufficient transmission capacity to serve Area loads and meet the applicable NPIRs for the contingency events noted below. The contingencies shall be applied to transmission elements and generating resources in order to examine the potential for the inability to meet the performance criteria as defined in this procedure on the New England PTF. Contingencies listed in Table 1 and Table 2 below that are expected to produce more severe impacts on the PTF shall be evaluated for system performance. The design shall assume power flow conditions with applicable transfers, loads, and resource conditions that reasonably stress the system.

In applying these criteria, it is recognized that it may be necessary to restrict the output of resources following the loss of a system element. This may be necessary to maintain system reliability in the event of a subsequent outage.

Remedial Action Schemes/Automatic Control Schemes (RAS/ACS) may be employed in the design of the interconnected power system. The addition, modification or retirement of a RAS/ACS on the New England Transmission System must be reviewed by the Reliability Committee and approved by ISO New England. For a RAS, such changes may also require review and approval by NPCC.

Conditions required for the design of the transmission system can be classified as:

N-0: All-facilities-in

N-1: All-facilities-in followed by a contingency

N-1-1: Scenarios that have contingency while a single element is out of service. After removal of the single element from service, system adjustments are made in preparation for the next contingency. These adjustments[1] can consist of any combination of the following:

a. Increasing resources available within ten minutes following notification
b. Adjustments that can be achieved in thirty minutes such as:
    - Generator runback and/or generator tripping
    - Reducing transfers on HVDC facilities
    - Adjusting phase angle regulators, transformer load tap changers, and variable reactors
    - Switching series and shunt capacitors and reactors.
    - Reducing imports from external Areas.

The contingencies and the performance requirements for each condition are listed in Table 1 and Table 2 below.

[1] Total increase in resource adjustment must not exceed 1,200 MW.

Table 1: N-1[2]

Initial Condition		Event	Performance Requirements[3]	
			Steady-State	**Stability[4]**
All Facilities-In	1.0	No contingency	PTF facilities shall have equipment loadings within normal limits. PTF voltages shall be within normal limits. All NPIRs shall be met.	The system shall remain in a state of equilibrium.
	1.1	Permanent three phase fault with normal fault clearing on a: • Generator • Transmission Circuit • Transformer • Bus Section • Shunt Device	PTF facilities shall have equipment loadings within applicable emergency limits for the system conditions that exist following the contingency PTF voltages shall be within applicable emergency limits for the system conditions that exist following the contingency	The system shall remain stable. Cascading and uncontrollable islanding that result in the loss or unintentional separation of major portions of the PTF transmission system shall not occur. Individual generating units ≥ 5 MW[5] shall not lose synchronism or trip.
	1.2	Simultaneous permanent phase-to-ground faults on different phases of each of two adjacent transmission circuits on a multiple		

[2] As described in Section 1 of this Planning Procedure, NERC and NPCC design criteria may be more stringent that what is contained in these standards. Therefore, meeting the requirements set forth in this document does not assure that NERC and NPCC's criteria have also been met.
[3] The performance of generating facilities that are ≥5 MW and ≤20 MW and that are connected to the system at voltage less than 69 kV will be evaluated in accordance with the interconnection performance requirements of those generating facilities.
[4] The testing of contingencies and the application of criteria shall consider automatic reclosing. Manual system adjustments to facilitate reclosing are not permitted.
[5] For the purposes of this performance requirement, a unit's size shall be defined by its Winter Network Resource Capability (Winter NRC) rating.

		circuit tower with normal fault clearing If multiple circuit towers are used only for station entrance and exit purposes and if they do not exceed five towers at each station and the total length of multiple circuit towers is less than one mile, then this condition is considered an acceptable risk and this contingency does not need to be considered	All NPIRs shall be met following contingencies	Total source loss shall remain below 1,200 MW, unless the source loss is entirely caused by the operation of a protection system designed to isolate the faulted element.[6] Any set of units totaling more than 20 MW, other than distributed energy resources interconnected in accordance with IEEE Standard 1547-2003, shall not lose synchronism or trip.[7] All modeled units and transmission facilities, such as HVDC, FACTs devices, etc. shall remain damped in accordance with the criterion specified in Appendix C. Transient voltage criteria as specified in Appendix D shall be
	1.3	Permanent phase-to-ground fault with a breaker failure on a: • Generator • Transmission Circuit • Transformer • Bus Section • Shunt Device		
	1.4	Circuit Breaker open without a fault		
	1.5	Simultaneous loss of both poles of a DC bipolar facility without an AC fault		
	1.6	The failure of a circuit breaker to operate when initiated by a Type I SPS following: • Breaker opening without a fault • Permanent phase-to-ground fault with normal fault clearing on any: o Transmission Circuit		

[6] For example, the loss of a single 1,250 MW generator due to a fault on that generator's step-up transformer is permissible, subject to the "Interconnection Design – Loss-of-Source" requirements in Appendix A of Planning Procedure 5-6. The loss of a single 1,100 MW generator for the same condition, along with 150 MW of distributed energy resources at other locations (including those interconnected under IEEE Standard 1547-2003), is not acceptable due to a total source loss exceeding 1,200 MW. Further explanation of this requirement may be found in Appendix E of this procedure.

[7] For example, this includes a set of individual turbines within a wind plant or several geographically distant plants of any size, unless they are specifically addressed in footnote 3. IEEE 1547-2003 DER shall continue to be subject to the previous requirement that total source loss shall remain below 1,200 MW.

		○ Transformer ○ Bus Section ○ Shunt device ○ Generator		met.

Table 2: N-1-1[8]

Initial Condition		Contingency Event	Performance Requirements[9]	
			Steady-State	**Stability**[10]
Single element out of service • Generator • Transmission Circuit • Transformer • HVDC Pole • Shunt Device • Series Device	2.1	Permanent three phase fault with normal fault clearing on a: • Generator • Transmission Circuit • Transformer • Shunt Device	PTF facilities shall have equipment loadings within applicable limits pre-contingency and for the system conditions that exist following the contingency PTF voltages shall be within applicable limits for pre-disturbance conditions and for the system conditions that exist following the contingency All NPIRs shall be met following contingencies	The system shall remain stable. Cascading and uncontrollable islanding that result in the loss or unintentional separation of major portions of the PTF transmission system shall not occur. Individual generating units ≥ 5 MW[11] shall not lose synchronism or trip. Total source loss shall remain below 1,200 MW, unless the source loss is entirely caused by the operation of a protection system designed to isolate the faulted element.[12]
	2.2	Circuit breaker open without a fault		
	2.3	Permanent phase-to-ground fault on a HVDC Pole		
	2.4	Loss of a bipolar DC line		

[8] As described in Section 1 of this Planning Procedure, NERC and NPCC design criteria may be more stringent that what is contained in these standards. Therefore, meeting the requirements set forth in this document does not assure that NERC and NPCC's criteria have also been met.
[9] The performance of generating facilities that are ≥5 MW and ≤20 MW and that are connected to the system at voltage less than 69 kV will be evaluated in accordance with the interconnection performance requirements of those generating facilities.
[10] The testing of contingencies and the application of criteria shall consider automatic reclosing. Manual system adjustments to facilitate reclosing are not permitted.
[11] For the purposes of this performance requirement, a unit's size shall be defined by its Winter Network Resource Capability (Winter NRC) rating.
[12] For example, the loss of a single 1,250 MW generator due to a fault on that generator's step-up transformer is permissible, subject to

				Any set of units totaling more than 20 MW, other than distributed energy resources interconnected in accordance with IEEE Standard 1547-2003, shall not lose synchronism or trip.[13] All modeled units and transmission facilities, such as HVDC, FACTs devices, etc. shall remain damped in accordance with the criterion specified in Appendix C. Transient voltage criteria as specified in Appendix D shall be met.

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the "Interconnection Design – Loss-of-Source" requirements in Appendix A of Planning Procedure 5-6. The loss of a single 1,100 MW generator for the same condition, along with 150 MW of distributed energy resources at other locations (including those interconnected under IEEE Standard 1547-2003), is not acceptable due to a total source loss exceeding 1,200 MW. Further explanation of this requirement may be found in Appendix E of this procedure.

[13] For example, this includes a set of individual turbines within a wind plant or several geographically distant plants of any size, unless they are specifically addressed in footnote 9. IEEE 1547-2003 DER shall continue to be subject to the previous requirement that total source loss shall remain below 1,200 MW.

FAULT CURRENT ASSESSMENT

The New England PTF shall be designed to ensure equipment capabilities are adequate for fault current levels with all transmission and generation facilities in service for all potential operating conditions.

Document History[13]

Rev. 0 Rec.: RTPC - 6/8/99; App.: NEC - 7/9/99
Rev. 1 Rec.: RC - 12/7/04; App.: PC - 1/7/05
Rev. 2 Eff.: 2/1/05
Rev. 3 Rec.: RC – 8/29/06; Rec. PC – 10/13/06; Eff. 10/13/06
Rev. 4 Rec.: RC – 5/19/09; Rec. PC – 6/05/09; Eff. 6/11/09
Rev. 5 Modifications Only Address NERC Standard NUC-001-2
Rec.: RC – 2/26/10; Rec. PC – 3/05/10; Eff. 3/05/10
Rev. 6 Rec.: RC – 2/14/13; Rec. PC – 3/01/13; Eff. 3/01/13
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Rev. 10 Rec.: RC – 02/22/2023; Rec. PC – 04/06/2023; Eff. 04/12/2023

[13] This Document History documents action taken on the equivalent NEPOOL Procedure prior to the RTO Operations Date as well as revisions to the ISO New England Procedure subsequent to the RTO Operations Date.

APPENDIX "C" Damping Criterion

The purpose of the damping criterion is to assure small signal stability of the New England PTF system. System damping is characterized by the damping ratio, zeta (ζ). The damping ratio provides an indication of the length of time an oscillation will take to dampen. The damping criterion specifies a minimum damping ratio of 0.03, which corresponds to a 1% settling time of one minute or less for all oscillations with a frequency of 0.4 Hz or higher. Conformance with the criterion may be demonstrated with the use of small signal eigenvalue analysis to explicitly identify the damping ratio of all questionable oscillations.

Time domain analysis may also be utilized to determine acceptable system damping. Acceptable damping with time domain analysis requires running a transient stability simulation for sufficient time (up to 30 seconds) such that only a single mode of oscillation remains. A 53% reduction in the magnitude of the oscillation must then be observed over four periods of the oscillation, measuring from the point where only a single mode of oscillation remains in the simulation.

As an alternate method, the time domain response of system state quantities such as generator rotor angle, voltage, and interface transfers can be transformed into the frequency domain where the damping ratio can be calculated.

A sufficient number of system state quantities including rotor angle, voltage, and interface transfers should be analyzed to ensure that adequate system damping is observed.

APPENDIX "D" Transient Voltage Criterion

Transient Voltage Response: The voltage at all the PTF buses that serve load or buses that are connected to load-serving transformers shall not stay below 0.8 p.u. for longer than 10 seconds from fault inception.

APPENDIX "E" Determining Acceptability of Source Loss

The following flowchart is intended to clarify the performance requirements regarding source loss contained in Tables 1 and 2. Note that only source loss-related performance requirements are addressed in this flowchart; other requirements, such as equipment loadings and voltages being within acceptable limits, are not addressed here.