



NERC TPL-007-4 R3

GMD Steady State Voltage Performance

Stan Sliwa
Lead Engineer, Transmission Planning
Planning Committee
July 12, 2022

- Each responsible entity, as determined in Requirement R1, shall have criteria for acceptable System steady state voltage performance for its System during the GMD events described in Attachment 1.

Table 1: Steady State Planning GMD Event				
Steady State: <ul style="list-style-type: none"> a. Voltage collapse, Cascading and uncontrolled islanding shall not occur. b. Generation loss is acceptable as a consequence of the steady state planning GMD events. c. Planned System adjustments such as Transmission configuration changes and re-dispatch of generation are allowed if such adjustments are executable within the time duration applicable to the Facility Ratings. 				
Category	Initial Condition	Event	Interruption of Firm Transmission Service Allowed	Load Loss Allowed
Benchmark GMD Event – GMD Event with Outages	1. System as may be postured in response to space weather information ¹ , and then 2. GMD event ²	Reactive Power compensation devices and other Transmission Facilities removed as a result of Protection System operation or Misoperation due to harmonics during the GMD event	Yes ³	Yes ³
Supplemental GMD Event – GMD Event with Outages	1. System as may be postured in response to space weather information ¹ , and then 2. GMD event ²	Reactive Power compensation devices and other Transmission Facilities removed as a result of Protection System operation or Misoperation due to harmonics during the GMD event	Yes	Yes
Table 1: Steady State Performance Footnotes				
<ol style="list-style-type: none"> 1. The System condition for GMD planning may include adjustments to posture the System that are executable in response to space weather information. 2. The GMD conditions for the benchmark and supplemental planning events are described in Attachment 1. 3. Load loss as a result of manual or automatic Load shedding (e.g., UVLS) and/or curtailment of Firm Transmission Service may be used to meet BES performance requirements during studied GMD conditions. The likelihood and magnitude of Load loss or curtailment of Firm Transmission Service should be minimized. 				

- Steady state voltage criteria established pursuant to:
 - PJM Manual 03: Transmission Operations
 - Section 3: Voltage & Stability Operating Guidelines
 - PJM Manual 14B: PJM Region Transmission Planning Process
 - Section 2: Regional Transmission Expansion Plan Process
 - PJM Manual 39: Nuclear Plant Interface Coordination
 - Section 1: Nuclear Plant Interface Requirements

- Voltage performance during GMD events are examined in three stages:
 - **Stage 1** Initial Condition
 - System postured in response to space weather information
 - **Stage 2** GMD Event
 - GMD event occurs but prior to loss of elements per Event description in Table 1 of TPL-007-4
 - **Stage 3** GMD Event with Outages
 - Loss of reactive power compensation devices and other Transmission Facilities as a result of Protection System operation / misoperation

- System may be postured in anticipation of a GMD event
 - Adjustments made that are executable in response to space weather information
- Steady state voltage performance shall be consistent with:
 - Category P0 (No Contingency) per the TPL-001 standard
- Voltage limits applied during Stage 1 will be the same as applied in PJM Operations for normal scenarios
 - Normal Low (NL) and Normal High (NH) baseline voltage limits as per Manual 03: Transmission Operations, Section 3

- The effects of GMD are modeled as reactive losses on the transmission system
 - Reduced voltages are expected
- Steady state voltage performance shall be consistent with:
 - Category P1 (Single Contingency) per the TPL-001 standard
- Voltage limits applied during Stage 2 will be the same as applied in PJM Operations for contingency scenarios
 - Emergency Low (EL) and Emergency High (EH) baseline voltage limits as per Manual 03: Transmission Operations, Section 3

- Facilities susceptible to harmonics are removed from service as a result of protection system operation / misoperation
- Voltage limits applied during Stage 3 will be the Load Dump limit used in PJM Operations
 - Load Dump (LD) baseline voltage limit as per Manual 03: Transmission Operations, Section 3

- All PJM Transmission System facilities 100 kV and greater will be monitored
- Cascading, Voltage Collapse and Uncontrolled Islanding shall not occur
- Nuclear Plant Interface Requirement (NPIR) voltage limits respected
- TO criteria if more restrictive than baseline voltage limits will be used instead

SME/Presenter:

Stanley Sliwa,
Stanley.Sliwa@pjm.com

NERC TPL-007-4 R3
GMD Steady State Voltage Performance



Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

**PROTECT THE
POWER GRID**
**THINK BEFORE
YOU CLICK!**



Be alert to
malicious
phishing emails.

Report suspicious email activity to PJM.
(610) 666-2244 / it_ops_ctr_shift@pjm.com

