



Voltage Emergencies

PJM State & Member Training Dept.



Objectives

The Student will be able to:

- Identify the process and requirements for operating during voltage emergencies

Low Voltage Alert

- Purpose
 - Heighten awareness, increase planning, analysis and prepare for when heavy loads and low voltages are anticipated in an upcoming operation period
 - Issued to Generation and Transmission members
 - Can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s)

Low Voltage Alert

PJM Actions

- Conduct power flow analysis of future load and transfer increases on the PJM system
 - Evaluate and plan using the analysis, to include:
 - Ensuring necessary Off-cost generation is ready to respond to transfer constraints
 - Consider changing the Reactive Transfer back off limit from 50 MW to 300 MW
 - Review generation and transmission outages
 - Assess impacts of transfers and prepare to curtail transactions impacting the reactive transfer limits
 - Enhance reactive reporting by requesting an RRC
 - Keep members informed via SOS Conference calls
 - Cancel the alert when appropriate

Low Voltage Alert

PJM Member Actions

- Transmission and Generation members notify their management, stations and key personnel
- Defer and maintenance or testing affecting capacity or critical transmission
- Respond to the Reactive Reserve Check

Heavy Load Voltage Schedule Warning

- Purpose
 - Issued to members to prepare for maximum support of voltages on the bulk power system
 - Can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s)

Heavy Load Voltage Schedule Warning

PJM Actions

- Issue Heavy Load Voltage Schedule Warning to members 4 hours prior to requesting actual implementation
- Request members to take all actions on distribution and sub-transmission system to support voltage at the EHV level

Heavy Load Voltage Schedule Warning

PJM Member Actions

- Ensure, where possible, while still observing established limits
 - Underlying reactors are out of service
 - Underlying capacitors are in service
 - Transformer taps are adjusted to ensure distribution caps are in service
 - Voltage regulators are in service on generating units

Heavy Load Voltage Schedule Action

- Purpose
 - Issued at peak load levels to request maximum support of voltage on the bulk power system
 - Increase reactive reserves on the 500 kV system
 - Can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of Control Zone(s)

Heavy Load Voltage Schedule Action

PJM Actions

- Request all companies implement Heavy Load Voltage Schedule
- Cancel when appropriate

Heavy Load Voltage Schedule Action

PJM Member Actions

- Ensure where possible, while still observing established limits
 - Underlying reactors are out of service
 - Underlying capacitors are in service
 - Capacitors on the 500 kV system with PLCs are in service
- Ensure all unit voltage regulators are in service
- Units on the 230 kV system and below should increase MVAR output as necessary to maintain scheduled bus voltages or nominal voltages, whichever is greater
- Units on the 500 kV and above system are operated to maintain a reasonable MVAR reserve
 - Reactive moves on these units should be coordinated with PJM
- Inform PJM of any units approaching max MVAR output, unit MVAR restrictions or AVRs out of service

High System Voltage

- Purpose
 - Prepare the system for expected high voltages
 - Coordinate with Transmission owners to take steps to control high voltage prior to entering a light load period
 - Take actions in real time when portions of the PJM RTO are experiencing a low load/high voltage condition

High System Voltage

PJM Actions

- Issue High System Voltage message
- Direct all companies to take actions to control high system voltages
 - Switchable capacitors be disconnected and switchable reactors be connected
- Generators, synchronous condensers and SVCs within their zone to absorb reactive power
 - Coordinate with Transmission and Generation owners to direct generators to operate outside voltage schedules

High System Voltage

PJM Actions (cont.)

- Request neighboring Balancing Authorities to assist in reducing voltage
- Adjust 500/230 kV transformer taps to optimize system voltage
- PJM has identified several circuits that, in the past, have been effective in controlling general PJM RTO high voltage conditions when they are removed from service

High System Voltage

Member Actions:

- The TO will review and request adjustments to generator excitation (within approved bandwidth) so units absorb reactive power as modeled in the reported unit D-curve
- Generation should operate at the lower bandwidth of their voltage schedule when possible
 - Example: A generator following a voltage schedule of 235 kV +/- 4 kV should be operating to 231 kV if possible
- Voltage schedule adjustments or excitation adjustments outside of the approved bandwidth shall be coordinated with PJM
- Generation communicate with PJM and TOs any restrictions on unit ability to absorb MVARs if it varies from reported capability

Resources and References

- PJM Manual 13: Emergency Operations, Revision 56 (2014) Linked from;
<http://www.pjm.com/~media/documents/manuals/m13.ashx>