

PJM Compliance Bulletin

NERC Standard PRC-001-1 – System Protection Coordination

NERC Standard PRC-001 “System Protection Coordination” is applicable to PJM, as the registered Transmission Operator (TOP); however, system protection activities are performed by the member Transmission Owners (TO), Generator Owners (GO), and Generator Operators (GOP).

This Compliance Bulletin provides guidance on the respective responsibilities of PJM and the member companies in order for PJM to demonstrate compliance with PRC-001-1.

This Compliance Bulletin also serves as a supplement to the PJM TO-TOP Reliability Matrix, which is an index of all tasks that overlap the Transmission Operator and Transmission Owner definitions.

However, this document is not meant to supplant any PJM or Member Agreements, PJM Manuals or the PJM TO-TOP Reliability Matrix. Any discrepancies or conflicts should be resolved giving priority to those documents, as appropriate. The content of this document does not replace any obligations in any other PJM document.

Requirements Related to Operations Activities

R1. Each Transmission Operator, Balancing Authority, and Generator Operator shall be familiar with the purpose and limitations of protection system schemes applied in its area.¹

PJM Expectations of Members

PJM expects that TOs will maintain documentation regarding the purpose and limitation of transmission protection systems installed in their TO footprint. This documentation may include, but is not limited to drawings (AC and DC schematics, single line diagrams, etc), scheme descriptions, and relay settings.

System Operators at TOs shall be familiar with the purposes and limitations of the transmission protection systems installed in their TO footprint.

TOs will provide documentation related to any transmission protection system to PJM upon request.

¹ This requirement is also related to TOP-006-1, Requirement 3:
Each Reliability Coordinator, Transmission Operator, and Balancing Authority shall provide appropriate technical information concerning protective relays to their operating personnel.

Actions by PJM

PJM ensures the PJM operators are familiar with the purpose and limitations of protection systems through various documents and training programs. Examples include:

- Section 5 of *PJM Manual 3 (v 37, issued 06/18/2010): Transmission Operations*, which documents operating procedures used by PJM and member Transmission Owners, including specific relay and Special Protection System (SPS) information and limitations.
- Tickets submitted through eDart, which include relay information that may impact the approval and coordination of outage. (e. g. in-service relay work, or using backup protection systems)
- Restoration plans with critical relay information (e.g. underfrequency load shedding systems).^{2 3}
- Documented affects of relays on the thermal ratings of Bulk Electric System (BES) facilities.⁴
- Description of EMS Category 6 facilities.
- Description of location and limitations due to directional relaying.
- Annual training modules presented to PJM operators.

In addition, PJM Operators may contact operations staff at member Transmission Owners companies for additional technical relay information to better understand the impact of any transmission protection system on the BES.

R2. Each Generator Operator and Transmission Operator shall notify reliability entities of relay or equipment failures as follows:

R2.1. If a protective relay or equipment failure reduces system reliability, the Generator Operator shall notify its Transmission Operator and Host Balancing Authority. The Generator Operator shall take corrective action as soon as possible.

² Refer to member Transmission Owners restoration plans.

³ Refer to PJM Manual 13: Emergency Operations, Attachment F: PJM Manual Load Dump Capability, Revision 42, effective January 24, 2011.

⁴ Refer to member Transmission Owners facility rating methodologies

PJM Expectations of Members

PJM expects that all GOs will report all protection system failures and protection system outages on any Reportable Facilities that are a part of the Bulk Electric system to PJM Operations.⁵

- R2.2. If a protective relay or equipment failure reduces system reliability, the Transmission Operator shall notify its Reliability Coordinator and affected Transmission Operators and Balancing Authorities. The Transmission Operator shall take corrective action as soon as possible.*

PJM Expectations of Members

PJM expects that all TOs will reports all protection system failures and protection system outages on EHV facilities (345 kV and above) through the PJM eDart tool. Any protection system failures and outages on any other Reportable Facilities that are a part of the Bulk Electric System shall be reported to PJM Operations.⁶

Actions by PJM

PJM will study all reported protection outages to determine the impact on reliable operations and notify neighboring entities as appropriate.⁷

- R6. Each Transmission Operator and Balancing Authority shall monitor the status of each Special Protection System in their area, and shall notify affected Transmission Operators and Balancing Authorities of each change in status.*

PJM Expectations of Members

PJM expects that all TOs monitor the status of Special Protection Systems and notify PJM of any change in status (enabled or disabled).

Requirements Related to Planning Activities

- R3. A Generator Operator or Transmission Operator shall coordinate new protective systems and changes as follows.*

- R3.1. Each Generator Operator shall coordinate all new protective systems and all protective system changes with its Transmission Operator and Host Balancing Authority.*

⁵ Refer to PJM Manual 3: Transmission Operations, Section 4: Reportable Transmission Facility Outages, Revision 37, effective June 18, 2010.

⁶ Refer to PJM Manual 3: Transmission Operations, Section 4: Reportable Transmission Facility Outages, Revision 37, effective June 18, 2010.

⁷ Refer to PJM Manual 38: Operations Planning, Attachment B: Transmission Reliability Analysis Procedure, Revision 4, effective January 1, 2010.

PJM Expectations of Members

PJM expects that all GOs and GOPs coordinate protection systems with the local interconnected TO. If the GO or GOP installs the new system or initiates a change that affects the transmission system, it is the responsibility of the GOs or GOPs to contact the local interconnected Transmission Owner in addition to notifying PJM.⁸

Documentation

GOs and GOPs shall coordinate protection systems with the local TOs and shall notify PJM of these coordination activities at the address

Regional_Compliance@pjm.com.

- R3.2. Each Transmission Operator shall coordinate all new protective systems and all protective system changes with neighboring Transmission Operators and Balancing Authorities.*

PJM Expectations of Members

PJM expects that all member TOs coordinate any new protection system or any modification that changes the performance of the system with neighboring entities.

At a minimum, TOs will coordinate any new or modified protection systems applied on the tie line(s) in question and shall also coordinate relative to any new or modified protection systems applied on adjacent lines if an impact on the performance of the protection systems of other TOs could reasonably be expected.

In general, coordination must occur when a modification is made to a protection system that changes its performance. The list below provides general guidance, but is not an all inclusive list of examples.

Examples of modifications that may change the performance of a protection system include, but are not limited to:

- Changes in the reach or pickup of any protection system (e.g. increasing the reach of a distance relay or increasing the pickup of an overcurrent relay)
- Changes in the clearing time of a protection system (e.g. changing the time delay of a distance relay or the time dial of an overcurrent relay)

⁸ Refer to PJM Manual 3: Transmission Operations, Section 4: Reportable Transmission Facility Outages, Revision 37, effective June 18, 2010.

- Changes in the communication channels (e.g. upgrading from analog phone pairs to fiber optic communication or changing from DCB to POTT communication)
- Changes in the protection system to incorporate new protective functions (e.g. enabling new tripping functions in a microprocessor relay)

Examples of modifications that fall under the scope of the NERC Protection System definition⁹ that, usually, do not require coordination include:

- Changes in current transformers (CTs) or potential transformers (PTs), provided these changes do not change the reach or pickup of any relay
- Changes in the station batteries
- Changes in the DC control circuitry
- Installing or modifying Disturbance Monitoring Equipment or disturbance monitoring functions within a protective system element

Documentation

All coordination activities will be documented and tracked by the PJM Relay Subcommittee:

- Two, or more, TOs that are contained within the PJM footprint will document coordination activities on “Coordination of Shared Facilities” list maintained by the PJM Relay Subcommittee
- PJM TOs coordinating protection with a non-PJM entity contained in an adjacent Transmission Operation (TOP) footprint shall post evidence of compliance (e-mails, memos, meeting minutes, etc) on the PJM Relay Subcommittee SharePoint site.
- If any TO chooses to archive this evidence of compliance with their internal systems, the TO shall post a file on the PJM Relay Subcommittee SharePoint site describing what is archived and clear directions on how PJM can obtain this information.
- PJM expects that the TO will be able to provide all requested documentation.

⁹ NERC defines Protection System as “Protective relays which respond to electrical quantities, Communications systems necessary for correct operation of protective functions, Voltage and current sensing devices providing inputs to protective relays, Station dc supply associated with protective functions (including batteries, battery chargers, and non-battery-based dc supply), and Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.” NERC Glossary of Terms Used in Reliability Standards, updated March 15, 2011.

- R4. *Each Transmission Operator shall coordinate protection systems on major transmission lines and interconnections with neighboring Generator Operators, Transmission Operators, and Balancing Authorities.*

PJM Expectations of Members

PJM expects that all TOs coordinate protection systems with interconnected GOPs. In the event that a protection system affects multiple TOs and GOPs, each TOs shall be responsible to contact the GOPs in their footprint.

At a minimum, TOs will coordinate any new or modified protection systems involving the interface between the TO and the GOP, and shall also coordinate relative to any new or modified protection systems applied on lines emanating from the facility in question if an impact on the performance of the protection systems of the GOP could reasonably be expected.

In general, coordination must occur when a modification is made to a protection system that changes its performance. The list below provides general guidance, but is not an all-inclusive list of examples. PJM expects that protection engineers at the TO and GO will use reasonable engineering judgment to determine when coordination is required.

Documentation

All coordination activities will be documented and tracked by the PJM Relay Subcommittee:

- PJM TOs coordinating protection with any interconnected GOP shall post communication (e-mails or memos) on the PJM Relay Subcommittee SharePoint site
- If any TO chooses to archive this evidence of compliance with their internal systems, the TO shall post a file on the PJM Relay Subcommittee SharePoint site describing what is archived and clear directions on how PJM can obtain this information.
- PJM expects that the TO will be able to provide all requested documentation within two calendar weeks.

- R5. *A Generator Operator or Transmission Operator shall coordinate changes in generation, transmission, load or operating conditions that could require changes in the protection systems of others:*

R5.1. Each Generator Operator shall notify its Transmission Operator in advance of changes in generation or operating conditions that could require changes in the Transmission Operator's protection systems.

PJM Expectations of Members

PJM expects that all GOPs will notify PJM of changes in the output of their generator through the normal Operations and Planning processes.

PJM Actions

PJM will communicate all system changes to the appropriate entities through the normal Operations and Planning processes

- R5.2. Each Transmission Operator shall notify neighboring Transmission Operators in advance of changes in generation, transmission, load, or operating conditions that could require changes in the other Transmission Operators' protection systems.*

PJM Expectations of Members

PJM expects that TOs will support the normal Operations and Planning processes to identify any changes in generation, transmission, load or other operating conditions that may require changes in protection systems. Any required changes will be coordinated as described in Requirement 3.

PJM Actions

PJM will communicate all system changes to the appropriate entities through the normal Operations and Planning processes

Document Retention

All evidence of compliance shall be retained in accordance with the document retention requirement as stated in the applicable NERC or Regional Reliability Standard. If there is no specific data retention requirement, the data will be retained for four years.

Development History

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Author:	Mark Kuras, Senior Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee	
Reviewers:	Patrick Brown, Manager, NERC & Regional Coordination	
Approver:	Tom Bowe, Executive Director, Reliability & Compliance	
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Revision: 0		Date: 11/19/2009
Author:	Susan McGill, Senior Engineer NERC and Regional Coordination Department	
Reviewers:	Patrick Brown, Manager NERC and Regional Coordination Chris Hein Chair, ROCC	
Approver:	Tom Bowe, Executive Director Reliability Integration Division	
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