

# PJM Compliance Bulletin

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## *CB001 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.<sup>1</sup>*

### **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 transmission protection systems installed in their TO footprint.

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

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<sup>1</sup> This requirement is also related to TOP-006-2, 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: Index and Operating Procedures for PJM RTO Operation*, 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).<sup>2 3</sup>
- Documented affects of relays on the thermal ratings of Bulk Electric System (BES) facilities.<sup>4</sup>
- 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.*

### **PJM Expectations of Members**

PJM expects that all GOs and GOPs 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.<sup>5</sup>

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<sup>2</sup> Refer to member Transmission Owners restoration plans.

<sup>3</sup> Refer to PJM Manual 13 : Emergency Operations, Attachment F: PJM Manual Load Dump Capability

<sup>4</sup> Refer to member Transmission Owners facility rating methodologies

<sup>5</sup> Refer to PJM Manual 3 : Transmission Operations, Section 4.2.2: Hotline / In Service Work Requests /Protective Relay Outages/Failures

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 report 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 requiring PJM to modify PJM EMS Network Application Contingencies shall be reported to PJM Operations.<sup>5</sup>

#### **Actions by PJM**

PJM will study all reported protection outages to determine the impact on reliable operations and notify neighboring entities as appropriate.<sup>6</sup>

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.*

#### **PJM Expectations of Members**

PJM expects that all GOs and GOPs coordinate protection systems with the local interconnected TOs. 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 Owners, for review and concurrence prior to the change. In addition, PJM expects that once concurrence has been provided by the local interconnected Transmission Owner, that all GOs and GOPs notify PJM of the concurrence but does not require PJM concurrence or acknowledgement of the change.<sup>5</sup>

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<sup>6</sup> Refer to PJM Manual 38 : Operations Planning, Attachment B, B.5 Internal Outage Review Process

### **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](mailto: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 Transmission Owners, Transmission Operators and Balancing Authorities.

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 if it is reasonably expected that the modification could have an effect on the operation of the protection system(s) of other transmission or generator operators. 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)
- 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 definition<sup>7</sup> 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 Protection on 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.

*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 addition to neighboring Transmission Owners, Transmission Operators,

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<sup>7</sup> 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, definition FERC approved 2/3/2012.

and Balancing Authorities. In the event that a protection system affects neighboring TOs and GOPs, each TO 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 TOs and GOPs will use reasonable engineering judgment to determine when coordination is required.

- 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)
- 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 definition<sup>9</sup> 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:

- 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<sup>10</sup> and Planning<sup>11</sup> processes.

#### **PJM Actions**

PJM will communicate all system changes to the appropriate entities through the normal Operations<sup>8</sup> and Planning<sup>9</sup> 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<sup>10</sup> and Planning<sup>11</sup> 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**

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<sup>8</sup> Refer to PJM Manual 38 Operations Planning, See various sections, Member TO Actions

<sup>9</sup> Refer to PJM Manual 14A Generation and Transmission Interconnection Process, Section 2: Generation and Transmission Interconnection Planning Process; PJM Manual 14B PJM Region Transmission Planning Process, Section 1.3 Planning Assumptions and Model Development and PJM Manual 14D Generator Operational Requirements, Section 7.3 Critical Information and Reporting Requirements





PJM will communicate all system changes to the appropriate entities through the normal Operations<sup>10</sup> and Planning<sup>11</sup> 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

Revision: 5      Date: 01/24/2017	
Author:	Mark Kuras, Senior Lead Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee
Reviewers:	Mark Holman, Manager, NERC and Regional Coordination Tom Moleski, Senior Consultant, NERC and Regional Coordination Phil D'Antonio, Manager, Reliability Engineering
Approver:	Robert Eckenrod, Chief Compliance Officer, Reliability and Compliance
Reason for Change:	Comprehensive Annual Review. Update of Manual revision dates. References added. Clarified Section 3.1 by including language that does not require TOP or RC approval to coordinated changes.



Revision: 4		Date: 09/10/2015
Author:	Mark Kuras, Senior Lead Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee	
Reviewers:	Mark Holman, Manager, NERC and Regional Coordination Tom Moleski, Senior Consultant, NERC and Regional Coordination Phil D'Antonio, Manager, Reliability Engineering	
Approver:	Tom Bowe, Executive Director, Reliability and Compliance	
Reason for Change:	Update of Manual revision dates. References added. Clarified Sections 3.1 and 3.2.	

Revision: 3		Date: 4/25/2014
Author:	Mark Kuras, Senior Lead Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee	
Reviewers:	Stephanie Monzon, Manager, NERC and Regional Coordination Tom Moleski, Senior Consultant, NERC and Regional Coordination Michael Bryson, Executive Director, System Operations	
Approver:	Tom Bowe, Executive Director, Reliability and Compliance	
Reason for Change:	Enhanced section R4 by adding same list as in Section R3.2 and clarifying the entities for coordination.	

Revision: 2		Date: 5/21/2012	
Author:	Mark Kuras, Senior Lead Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee		
Reviewers:	Stephanie Monzon, Manager, NERC and Regional Coordination		
Approver:	Tom Bowe, Executive Director, Reliability and Compliance		
Reason for Change:	Revised as part of annual review. Enhancement of Section R2.2 to clarify reporting requirements for BES lines below 345 kV. Updated Manual references.		

Revision: 1		Date: 4/28/2011	
Author:	Mark Kuras, Senior Engineer NERC and Regional Coordination Department Recommendations by the Relay Subcommittee		
Reviewers:	Patrick Brown, Manager, NERC and Regional Coordination		
Approver:	Tom Bowe, Executive Director, Reliability and Compliance		
Reason for Change:	Revised as part of annual review. Enhancement of Section R3.2. Enhancement to section R4 and the addition of the list of protection system changes that may change performance of a protection system.		

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		

Reason for Change:	This is a newly developed document.
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