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 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 (Ver. 43, issued June 1, 2013): 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.*

**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.\(^5\)

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\(^2\) Refer to member Transmission Owners restoration plans.  
\(^3\) Refer to PJM Manual 13 (Rev. 53, effective June 1, 2013): Emergency Operations, Attachment F: PJM Manual Load Dump Capability  
\(^4\) Refer to member Transmission Owners facility rating methodologies
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.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.

**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

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⁵ Refer to PJM Manual 3 (Rev. 43, effective June 1, 2013): Transmission Operations, Section 4.2.2: Hotline / In Service Work Requests /Protective Relay Outages/Failures
⁶ Refer to PJM Manual 3 (Rev. 43, effective June 1, 2013): Transmission Operations, Section 4.2.2: Hotline / In Service Work Requests /Protective Relay Outages/Failures
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 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. 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)

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\(^8\) Refer to PJM Manual 3 (Rev. 43, effective June 1, 2013): Transmission Operations, Section 4.2.2: Hotline / In Service Work Requests /Protective Relay Outages/Failures
Examples of modifications that fall under the scope of the NERC Protection System definition\(^9\) 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.

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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\(^9\) 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, definition FERC approved 2/3/2012.
and Balancing Authorities. In the event that a protection system affects multiple 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 TO and GOP 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 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 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

<table>
<thead>
<tr>
<th>Revision: 3</th>
<th>Date: 8/12/2013</th>
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</table>
| 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. |

<table>
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<th>Revision: 2</th>
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| Author:     | Mark Kuras, Senior Lead Engineer  
NERC and Regional Coordination Department  
Recommendations by the Relay Subcommittee |
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| Approver:   | Tom Bowe, Executive Director, Reliability and Compliance |
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<table>
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| Author:     | Mark Kuras, Senior Engineer  
NERC and Regional Coordination Department  
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| 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. |

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</table>
| 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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