



NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

PRC-027-1

Coordination of Protection Systems for Performance
During Faults

Post-Approval Update
September 19, 2018

RELIABILITY | ACCOUNTABILITY





- **Project 2007-06 System Protection Coordination**
 - Began in 2007 to address issues with Reliability Standard PRC-001-1 System Protection Coordination identified by:
 - FERC in Order 693
 - NERC System Protection and Controls Task Force
 - Standard Development Process
 - SAR posted in June, 2007
 - Draft 6 passed final ballot in October, 2015
 - Adopted by the NERC BOT in November, 2015
 - FERC published NOPR in November, 2017
 - FERC issued Order No. 847 approving PRC-027-1 in June, 2018



- Requirements assigned to incorrect functional entities
- Requirements were vague and not measurable
- Standard mixed operating and planning time horizons
- Lack of clarity around the term “coordinate” and the phrase “major transmission lines” used in three of the six requirements
- Standard didn’t contain a requirement addressing short circuit modeling data



Member	Entity
Bill Middaugh, Chair	Tri-State Generation & Transmission Association
Forrest Brock	Western Farmers Electric Cooperative
Sam Francis	Oncor Electric Delivery
Jeff Iler	American Electric Power
Kevin Wempe	Kansas City Power and Light
Phil Winston	Southern Company

A map of North America, including the United States, Canada, and Mexico. A horizontal band of varying shades of blue and grey stretches across the middle of the map, passing through the United States and southern Canada. The text "PRC-027-1" is centered within this band.

PRC-027-1



- **Purpose**

- To maintain the coordination of Protection Systems installed to detect and isolate Faults on Bulk Electric System (BES) Elements, such that those Protection Systems operate in the intended sequence during Faults.

- **Functional Entities**

- Transmission Owner
- Generator Owner
- Distribution Provider (that owns Protection Systems identified in the Facilities section)

- **Facilities**

- Protection Systems installed to detect and isolate Faults on BES Elements



- **R1.** Each Transmission Owner, Generator Owner, and Distribution Provider shall establish a process for developing new and revised Protection System settings for BES Elements, such that the Protection Systems operate in the intended sequence during Faults. The process shall include:
 - **1.1.** A review and update of short-circuit model data for the BES Elements under study.
 - **1.2.** A review of the developed Protection System settings.



- **1.3.** For Protection System settings applied on BES Elements that electrically join Facilities owned by separate functional entities (Transmission Owners, Generator Owners, and Distribution Providers), provisions to:
 - **1.3.1.** Provide the proposed Protection System settings to the owner(s) of the electrically joined Facilities
 - **1.3.2.** Respond to any owner(s) that provided its proposed Protection System settings pursuant to Requirement R1, Part 1.3.1 by identifying any coordination issue(s) or affirming that no coordination issue(s) were identified.



- **1.3.3.** Verify that identified coordination issue(s) associated with the proposed Protection System settings for the associated BES Elements are addressed prior to implementation.
- **1.3.4.** Communicate with the other owner(s) of the electrically joined Facilities regarding revised Protection System settings resulting from unforeseen circumstances that arise during implementation or commissioning, Misoperation investigations, maintenance activities, or emergency replacements required as a result of Protection System component failure.



- **R2.** Each Transmission Owner, Generator Owner, and Distribution Provider shall, for each BES Element with Protection System functions identified in Attachment A:
 - Option 1: Perform a Protection System Coordination Study in a time interval not to exceed six calendar years; or
 - Option 2: Compare present Fault current values to an established Fault current baseline and perform a Protection System Coordination Study when the comparison identifies a 15 percent or greater deviation in Fault current values (either three phase or phase to ground) at a bus to which the Element is connected, all in a time interval not to exceed six calendar years;¹ or,
 - Option 3: A combination of the above.

- New Defined Term

- **Protection System Coordination Study (PSCS)**

An analysis to determine whether Protection Systems operate in the intended sequence during Faults.



- The initial Fault current baseline(s) shall be established by the effective date of this Reliability Standard and updated each time a Protection System Coordination Study is performed. The Fault current baseline for BES generating resources may be established at the generator, the generator step-up (GSU) transformer(s), or at the common point of connection at 100 kV or above. For dispersed power producing resources, the Fault current baseline may also be established at the BES aggregation point (total capacity greater than 75 MVA). If an initial baseline was not established by the effective date of this Reliability Standard because of the previous use of an alternate option or the installation of a new BES Element, the entity may establish the baseline by performing a Protection System Coordination Study.



- The following Protection System functions are applicable to Requirement R2 if available Fault current levels are used to develop the settings for those Protection System functions:
- 21 – Distance if:
 - infeed is used in determining reach (phase and ground distance), or
 - zero-sequence mutual coupling is used in determining reach (ground distance).
- 50 – Instantaneous overcurrent
- 51 – AC inverse time overcurrent
- 67 – AC directional overcurrent if used in a non-communication-aided protection scheme



- **R3.** Each Transmission Owner, Generator Owner, and Distribution Provider shall utilize its process established in Requirement R1 to develop new and revised Protection System settings for BES Elements.



- Implementation Plan

- Effective date is the first day of the first calendar quarter that is twenty-four (24) months after the date that the standard is approved by an applicable governmental authority. October 1, 2020
- Commensurate with implementation of PER-006-1 Specific Training for Personnel developed by the drafting team for Phase 2 of System Protection Coordination for the complete retirement of PRC-001-1.1(ii)

- Required on effective date:

- R1 – documented process
- R2 – a Fault current baseline (if using Option 2)
- R3 – utilize the process



- Corrects the Applicability
- Clarifies the purpose of the Standard
- Provides a clear set of Requirements that obligate entities to:
 - Establish and implement processes for developing and coordinating new and revised Protection System settings
 - Periodically verify that the Protection Systems that could be affected by incremental changes in Fault current remain coordinated (continue to operate in their intended sequence during Faults)
- Provides a specific list of the protection system functions on all Bulk Electric System elements that require coordination



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A stylized map of North America, including the United States, Canada, and Mexico. The map is divided into three horizontal bands of color: a light blue band across the top (Canada), a medium blue band across the middle (United States), and a light grey band at the bottom (Mexico). The text "End of Presentation" is centered over the middle band.

End of Presentation