

PRC-027-1
Coordination of Protection Systems for
Performance During Faults

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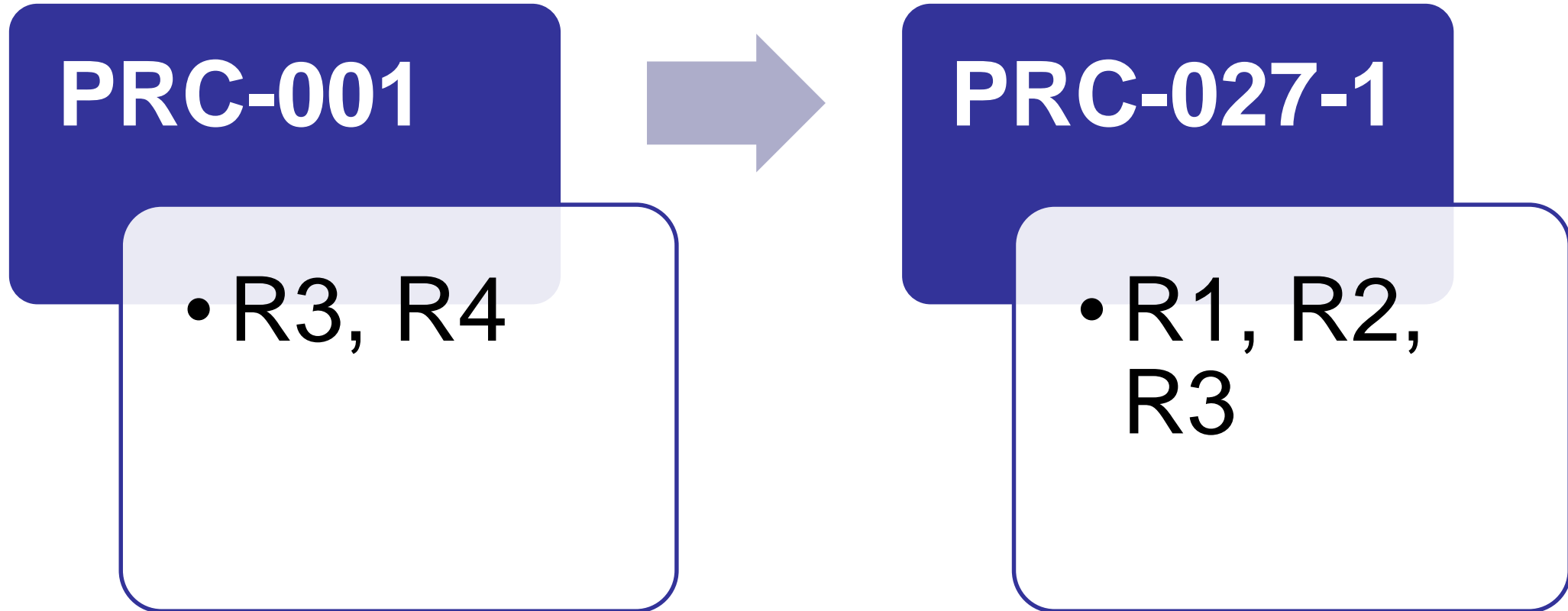
PRC-027-1 Background

- **Drafted as Part of Project 2007-06 System Protection Coordination**
 - Standard Authorization Request dated **May 7, 2007**
 - Identified purposes include:
 - Assure that Protection System application and performance issues are coordinated among all related entities
 - Correct the applicable entities within the standard to reflect the actual functional responsibilities, as described in the NERC Functional Model
 - Consider the observations and recommendations developed by the NERC System Protection and Control Task Force (SPCTF)

- **SPCTF Conclusions and Recommendations**

- As it exists today, enforcement of PRC-001-0 will be very difficult. The applicable entities in the existing Standard are incorrect for many of the requirements and the requirements themselves are vague and not measurable

PRC-027-1 Background



Generator Owners

Transmission Owners

Distribution Providers That Own:

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

PRC-027-1 Implementation Plan

- **Effective October 1, 2020**
 - Includes NERC Glossary term “Protection System Coordination Study”
 - “An analysis to determine whether Protection Systems operate in the intended sequence during Faults”
 - Six calendar year interval for R2 begins on Standard effective date
 - PRC-001-1.1(ii) retired at midnight of the day immediately prior to effective date

Establish Process for New or Revised Settings



Utilize Process for New or Revised Settings



Periodically Review Existing Settings

R1: 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:

Part 1.1 – A review and update of short-circuit model data for BES Elements under study

- Obtain model data
- Review model data
- Update model data

Part 1.2 – A review of developed Protection System settings

Systematic Process

- Roles and responsibilities
- Triggers
- Technical criteria
- Tools
- Documentation

Internal Control Example – Planned Settings Change

Protection Engineer Reviews Model and Develops Proposed Settings

Protection Engineer Creates Database Entry for Proposed Changes

Identified Personnel Performs and Documents Review Using Criteria Included in Process

Reviewer Changes Status of Database Entry to “Approved”

Checklist with Steps to Verify Proposed Changes in “Approved” State Prior to Implementing Changes

Part 1.3 – For Protection System settings applied on BES Elements that electrically join Facilities owned by separate functional entities, 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

**Part 1.3 - Settings
applied on BES
Elements that
electrically join
Facilities owned by
separate functional
entities**

- Roles and responsibilities
- Identification of applicable BES Elements
- Workflows associated with applicable changes
- Tie-ins to processes associated with unforeseen circumstances
- Controls to ensure issues resolved prior to implementation
- Criteria to evaluate settings received from other owners

R3: Utilize process established in Requirement R1 to develop new and revised Protection System settings for BES Elements.

Population

New or revised settings

- Planned setting changes
- Setting changes resulting from unforeseen circumstances
- Setting changes on BES Elements interconnected to other entities

Coordination issue(s) associated with proposed settings

Settings provided from other owners pursuant to Part 1.3.1

PRC-027-1 - Implementation

For new or revised settings

- Model review and update for related Facilities
- Internal review of developed settings
- Utilization of process

If settings applied on BES Elements that electrically join Facilities owned by separate functional entities

- Settings provided to interconnected entities
- Response obtained
- Issues resolved
- Utilization of process

**For settings received from other owner(s)
that provided its proposed Protection
System settings pursuant to Requirement
R1, Part 1.3.1**

**Review of
provided
settings**

**Response to
other
owner(s)**

**Utilization of
process**

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
- 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 BES Element is connected, all in a time interval not to exceed six calendar years
- Option 3: Use a combination of the above

Applicable to BES Elements with the following 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

Option 1:

- Protection System Coordination Study required within six calendar years of October 1, 2020
- Short-circuit model verification should be performed prior to study to ensure accuracy of calculated Fault currents
- Verify primary and backup relays are coordinated to operate as intended for BES Elements where Fault current based protective functions applied
 - Current pickups
 - Time delays
- Three-phase and single line-to-ground Fault currents necessary for verification

Option 2:

- Establish Fault current baseline prior to October 1, 2020
- Short-circuit model verification should be performed prior to study to ensure accuracy of calculated Fault currents
- Perform Fault current comparison within six calendar years of October 1, 2020
 - Include three-phase and single line-to-ground Fault currents
- Identify changes in Fault current greater than 15%
- Perform Protection System Coordination Study for BES Elements meeting 15% threshold

Option 3:

- Where Option 1 is utilized, Protection System Coordination Study must be completed within six calendar years of October 1, 2020
- Where Option 2 is utilized, establish Fault current baseline prior to October 1, 2020
- Separate options utilized for subsets of System
 - Voltage levels
 - Areas with substantial System changes
- Document methodology and justification for utilization of two options

Questions?

