

PRC-001-2 System Protection Coordination Supplementary Reference

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Disclaimer

This supporting document may explain or facilitate implementation of reliability standard PRC-001-2 — System Protection Coordination but does not contain mandatory requirements subject to compliance review.

Generator Protection Devices or Elements that May Require Coordination with Transmission or Distribution Protective Devices in Requirement R2

The following generation protective devices or elements may require coordination with transmission or distribution protective devices. Only those protective devices that trip the generator need to be reviewed for coordination. A generator's protection scheme may not require all of the devices listed below, dependent upon the design of the generation and transmission or distribution facilities. The latest revision of ANSI/IEEE C37.102[®] *IEEE Guide for AC Generator Protection* provides additional information regarding these devices.

As noted in this Standard, the Generator Owner shall supply the settings for those protective device elements that result in a generator trip and may require coordination verification to the Transmission Owner or Distribution Provider. The following is a typical list of these device elements:

- 21 — Distance (looking from generator out to system)
- 24 — Volts per Hertz (if Transmission Owner owns transformer bank)
- 27 — Undervoltage
- 46 — Negative Sequence Overcurrent
- 50/27 — Inadvertent Energization
- 50/50N/62 — Breaker failure (plant) on synchronizing breaker
- 51 — Step Up Transformer Phase Time Overcurrent
- 51TG — Step Up Transformer High Side Ground Time Overcurrent
- 51V — Voltage Restrained or Voltage Controlled Time Overcurrent
- 59 — Overvoltage
- 78 — Out-of-Step
- 81 — Over/Under Frequency

Transmission and Distribution Protection Devices or Elements that May Require Coordination with Generator Protective Devices in Requirement R3

The following transmission or distribution protective devices or elements may require coordination with generator protective devices. The transmission or distribution protection scheme may not require all of the devices listed below, dependent upon the design of the generation and transmission or distribution facilities. The latest revisions of ANSI/IEEE C37.102[®] *IEEE Guide for AC Generator Protection* and IEEE Std. C37.113[®] *IEEE Guide for Protective Relay Applications to Transmission Lines* provide additional information regarding these devices.

As noted in this Standard, the Transmission Owner or Distribution Provider shall supply the settings for the following transmission or distribution protective device elements that result in a trip and/or reclose and may require coordination verification to the Generation Owner:

- 21 — Distance
- 24 — Volt/Hertz elements (if Transmission Owner owns the step-up transformer bank or to coordinate with system underfrequency load shedding)
- 46 — Negative Sequence Overcurrent
- 50 — Instantaneous Overcurrent
- 51 — Time Overcurrent
- 50N — Instantaneous Ground Overcurrent
- 51N — Time Ground Overcurrent
- 67 — Directional Overcurrent
- 67N — Directional Ground Overcurrent
- 50/50N/62 — Breaker Failure
- 78 — Out-of-Step
- 79 — Reclosing elements
 - 25 — Sychrocheck supervision
 - 27L — Dead line supervision (remote end)
- 81 — Under/Over Frequency
- 87 — Differential relay

Transmission Protection Devices or Elements that May Require Coordination with Other Transmission Protective Devices in Requirement R3

The following transmission protective devices or elements may require coordination with the interconnecting Transmission Owner or Distribution Provider. The transmission protection scheme may not require all of the devices listed below, dependent upon the design of the transmission or distribution facilities. The latest revision of *IEEE C37.113 Guide for Protective Relay Application to Transmission Lines* provides additional information regarding these devices.

As noted in this Standard, the Transmission Owner or Distribution Provider shall supply the settings for the following transmission protective device elements that result in a trip and/or reclose and may require coordination verification to the interconnected Transmission Owner or Distribution Provider:

Non-communication-aided schemes

- 21 — Distance
- 46 — Negative Sequence Overcurrent
- 50 — Instantaneous Overcurrent
- 51 — Time Overcurrent
- 50N — Instantaneous Ground Overcurrent
- 51N — Time Ground Overcurrent
- 67 — Directional Overcurrent
- 67N — Directional Ground Overcurrent
- 50/50N/62 — Breaker Failure
- 78 — Out-of-Step
- 79 — Reclosing elements
- 87 — Differential

Communication-aided schemes

- AC Pilot-Wire relays
- Direct Underreaching Transfer Trip
- Directional Comparison Blocking
- Directional Comparison Hybrid
- Directional Comparison Unblocking
- Line Current Differential
- Permissive Underreaching Transfer Trip
- Permissive Overreaching Transfer Trip
- Phase Comparison

Typical Transmission Protection System Schemes for which Information May Need to be Provided to the Transmission Operator in Requirement R5

The following are some typical transmission Protection System schemes for which information may need to be provided to the Transmission Operator if special action is required for loss of or operation of those Protection System schemes:

Non-communication-aided schemes

- Breaker Failure
- Differential
- Loss of Potential
- Overcurrent
 - Instantaneous
 - Time
 - Directional
- Out-of-Step
- Reclosing
- Special Protection Systems or Remedial Action Schemes
- Step Distance

Communication-aided schemes

- AC Pilot-Wire relays
- Direct Transfer Trip
- Directional Comparison
- Directional Comparison Blocking
- Directional Comparison Hybrid
- Directional Comparison Unblocking
- Line Current Differential
- Permissive Overreaching Transfer Trip
- Permissive Under-reaching Transfer Trip
- Phase Comparison
- Special Protection Systems or Remedial Action Schemes

Typical Generator Protection System Schemes for which Information May Need to be Provided to the Generator Operator in Requirement R6

The following are some examples of typical generator Protection System schemes for which information may need to be provided to the Generator Operator if special action is required for loss of or operation of those Protection System schemes:

- Breaker Failure
- Differential
- Distance
- Inadvertent Energization
- Loss of Field
- Loss of Potential
- Out of Step
- Over/Under Frequency
- Over/Undervoltage
- Overcurrent
 - Time
 - Directional
 - Voltage Restrained or Voltage Controlled
 - Negative Sequence
- Reverse Power
- Stator Ground
- Special Protection Systems or Remedial Action Schemes
- Volts per Hertz