

## NERC SPCTF Assessment of Standards:

- PRC-005-1 — Transmission and Generation Protection System Maintenance and Testing
- PRC-008-0 — Underfrequency Load Shedding Equipment Maintenance Programs
- PRC-011-0 — UVLS System Maintenance and Testing
- PRC-017-0 — Special Protection System Maintenance and Testing

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**March 8, 2007**

A Technical Review of Standards

Prepared by the  
System Protection and Controls Task Force  
of the  
NERC Planning Committee

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This report and its attendant Standards Authorization Request were approved by the Planning Committee on March 21, 2007, for forwarding to the Standards Committee.

## Introduction

When the original scope for the System Protection and Control Task Force was developed, one of the assigned items was to review all of the existing PRC-series Reliability Standards, to advise the Planning Committee of our assessment, and to develop Standards Authorization Requests, as appropriate, to address any perceived deficiencies.

This report presents the SPCTF's assessment of PRC-005-1 – Transmission and Generation Protection System Maintenance and Testing. The report includes the SPCTF's understanding of the intent of this standard and contains specific observations relative to the existing standard.

The SPCTF sees the parallel intent for each of the PRC-005, PRC-008, PRC-011, and PRC-017 as being maintenance and testing standards for different protective systems. In fact, PRC-005 & PRC-008, and PRC-011 & PRC-017 have very similar format respectively. Since all protective relay systems require some means of maintenance and testing, it would seem that all protective system maintenance and testing could be included in one standard regardless of scheme type. The SPCTF recommends that these four standards be reduced to one standard covering the issues detailed for PRC-005 on maintenance and testing.

These four standards were developed primarily by translating the requirements of an earlier Phase I Planning Standard; thus they have not been previously subjected to a critical review of the Requirements.

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## Executive Summary

Reliability standards PRC-005, 008, 011, and 017 are intended to assure that Transmission & Generation Protection Systems are maintained and tested so as to provide reliable performance when responding to abnormal system conditions. It is the responsibility of the Transmission Owner, Generation Owner, and Distribution Provider to ensure the Transmission & Generation Protection Systems are maintained and tested in such a manner that the protective systems operate to fulfill their function.

Only PRC-005 will be commented on in detail although the other three standards have the same concerns.

SPCTF concluded that:

- Applicable to all four standards — The listed requirements do not provide clear and sufficient guidance concerning the maintenance and testing of the Protection Systems to achieve the commonly stated purpose which is “To ensure all transmission and generation Protection Systems affecting the reliability of the Bulk Electric System (BES) are maintained and tested.”
- Applicable to PRC-017 — Part of the stated purpose in PRC-017 states: “To ensure that maintenance and testing programs are developed and misoperations are analyzed and corrected.” The phrase “and misoperations are analyzed and corrected” is not clearly appropriate in a maintenance and testing standard. That is, the purpose is more appropriate in PRC-003 and PRC-004, which relate to the analysis and mitigation of protection system misoperations. Analysis of correct operations or misoperations may be an integral part of condition-based maintenance processes, but need not be mandated in a maintenance standard.
- Applicable to all four standards — The standards should clearly state which power system elements are being addressed.
- Applicable to all four standards — The requirements should reflect the inherent differences between different technologies of protection systems.

- Applicable to all four standards — The terms maintenance programs and testing programs should be clearly defined in the glossary. The terms “maintenance” and “testing” are not interchangeable, and the requirements must be clear in their application. Additional terms may also have to be added to the glossary for clarity.
- Applicable to all four standards — The requirements of the existing standards, as stated, support time-based maintenance and testing, and should be expanded to include condition-based and performance-based maintenance and testing. The R1.2 summary of maintenance and testing procedures needs to have some minimum defined sub-requirements to insure that the stated intent of the standards is met to support review by the compliance monitor.

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## **Assessment of PRC-005-1**

### **Purpose**

To ensure all transmission and generation Protection Systems affecting the reliability of the Bulk Electric System (BES) are maintained and tested.
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A review of PRC-005 indicates that this standard is intended to assure that all affected entities have adequate maintenance and testing programs for their Protection Systems to ensure reliability. SPCTF agrees with the Purpose statement of PRC-005-1.

### **General Comments**

The SPCTF offers the following general comments:

- None of the requirements within PRC-005-1 specifically indicate what minimum attributes should be included in protective system maintenance and testing procedures.
- For interval-based procedures, no allowable maximum interval is prescribed.
- None of the requirements in the existing PRC-005-1 reflect condition-based or performance-based maintenance and testing criteria.

Standard PRC-005 should clarify that two goals are being covered:

- The maintenance portion should have requirements that keep the protection system equipment operating within manufacturers’ design specification throughout the service life.
- The testing portion should have requirements that verify that the functional performance of the protection systems is consistent with the design intent throughout the service life.

## Applicability

- 4.1. Transmission Owners
- 4.2. Generation Owners
- 4.3. Distribution Providers that owns a transmission Protection System

Applicability 4.3 suggests that the definition of a Protection System in the Glossary of Terms should clarify how a Distribution Provider may be the owner of a transmission Protection System.

## Requirements

### *R1*

- R1.** Each Transmission Owner and any Distribution Provider that owns a transmission Protection System and each Generator Owner that owns a generation Protection System shall have a Protection System maintenance and testing program for Protection Systems that affect the reliability of the BES. The program shall include:
- R1.1.** Maintenance and testing intervals and their basis.
  - R1.2.** Summary of maintenance and testing procedures.

The following clarifications should be made to Requirement R1:

1. How is the phrase “that affect the reliability of the BES” to be interpreted? The standard should clearly specify which Protection Systems are subject to the requirements.
2. The standard should clearly specify which components of the Generation Protection System are subject to the requirements.

The following clarifications should be made to Subparts R1.1 & R1.2:

1. Interval-based, condition-based, or performance-based maintenance and testing minimum criteria should be established within R1.1, including, but not limited to the following:
  - a. For time-based maintenance and testing programs, maximum maintenance intervals should be specified.
  - b. For condition-based or performance-based maintenance and testing programs, the program should have sufficient justification and documentation.
2. Definitions should be established for the terms “maintenance programs” and “testing programs.”
3. A minimum set of attributes to be included in maintenance and testing programs should be established within R1.2.

**R2**

**R2.** Each Transmission Owner and any Distribution Provider that owns a transmission Protection System and each Generator Owner that owns a generation Protection System shall provide documentation of its Protection System maintenance and testing program and the implementation of that program to its Regional Reliability Organization on request (within 30 calendar days). The documentation of the program implementation shall include:

**R2.1.** Evidence Protection System devices were maintained and tested within the defined intervals.

**R2.2.** Date each Protection System device was last tested/maintained

The following clarification should be made to requirement R2:

- The appropriate entity should have their Protection System maintenance program and testing program and associated documentation, including maintenance records and testing records, available to its Regional Reliability Organization and NERC during audits or upon request within 30 days.

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## FERC Assessment of PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0

In the October 20, 2006 Notice of Proposed Rulemaking for adoption of NERC Standards (Docket Number RM06-16-000), the Federal Energy Regulatory Commission commented on these four standards and proposed changes. The observations and proposals are excerpted from the NOPR and included below.

### PRC-005-1

The Commission proposes to approve PRC-005-1 as mandatory and enforceable. In addition, we propose to direct that NERC develop modifications to the Reliability Standard as discussed below.

Proposed Reliability Standard PRC-005-1 does not specify the criteria to determine the appropriate maintenance intervals, nor do it specify maximum allowable maintenance intervals for the protection systems. The Commission therefore proposes that NERC include a requirement that maintenance and testing of these protection systems must be carried out within a maximum allowable interval that is appropriate to the type of the protection system and its impact on the reliability of the Bulk-Power System.

Accordingly, giving due weight to the technical expertise of the ERO and with the expectation that the Reliability Standard will accomplish the purpose represented to the Commission by the ERO and that it will improve the reliability of the nation's Bulk-Power System, the Commission proposes to approve Reliability Standard PRC-005-1 as mandatory and enforceable. In addition, pursuant to section 215(d)(5) of the FPA and § 39.5(f) of our regulations, the Commission proposes to direct that NERC submit a modification to PRC-005-1 that includes a requirement that maintenance and testing of a protection system must be carried out within a maximum allowable interval that is appropriate to the type of the protection system and its impact on the reliability of the Bulk-Power System.

## PRC-008-0

The Commission notes that the commenters generally share staff's concern that the proposed Reliability Standard does not specify the criteria to determine the appropriate maintenance intervals, nor does it specify maximum allowable maintenance intervals for the protection systems. The Commission agrees and proposes to require NERC to modify the proposed Reliability Standard to include a requirement that maintenance and testing of UFLS programs must be carried out within a maximum allowable interval that is appropriate to the type of relay used and the impact on the reliability of the Bulk-Power System.

Accordingly, the Commission proposes to approve Reliability Standard PRC-008-0 as mandatory and enforceable. In addition, the Commission proposes to direct that NERC submit a modification to PRC-008-0 that includes a requirement that maintenance and testing of UFLS programs must be carried out within a maximum allowable interval appropriate to the relay type and the potential impact on the Bulk-Power System.

## PRC-011-0

PRC-011-0 does not specify the criteria to determine the appropriate maintenance intervals, nor does it specify maximum allowable maintenance intervals for the protections systems. The Commission proposes that NERC include a Requirement that maintenance and testing of these UFLS programs must be carried out within a maximum allowable interval that is appropriate to the type of the relay used and the impact of these UFLS on the reliability of the Bulk-Power System.

The Commission believes that Reliability Standard PRC-011-0 serves an important purpose in requiring transmission owners and distribution providers to implement their UVLS equipment maintenance and testing programs. Further, the proposed Requirements are sufficiently clear and objective to provide guidance for compliance.

Accordingly, giving due weight to the technical expertise of the ERO and with the expectation that the Reliability Standard will accomplish the purpose represented to the Commission by the ERO and that it will improve the reliability of the nation's Bulk-Power System, the Commission proposes to approve Reliability Standard PRC-011-0 as mandatory and enforceable. In addition, pursuant to section 215(d)(5) of the FPA and § 39.5(f) of our regulations, the Commission proposes to direct that NERC submit a modification to PRC-011-0 that includes a requirement that maintenance and testing of UVLS programs must be carried out within a maximum allowable interval appropriate to the applicable relay and the impact on the reliability of the Bulk-Power System.

## PRC-017-0

PRC-017-0 does not specify the criteria to determine the appropriate maintenance intervals, nor does it specify maximum allowable maintenance intervals for the protections systems. The Commission proposes to require NERC to include a requirement that maintenance and testing of these special protection system programs must be carried out within a maximum allowable interval that is appropriate to the type of relaying used and the impact of these special protection system programs on the reliability of the Bulk-Power System.

Accordingly, giving due weight to the technical expertise of the ERO and with the expectation that the Reliability Standard will accomplish the purpose represented to the Commission by the ERO and that it will improve the reliability of the nation's Bulk-Power System, the Commission proposes to approve Reliability Standard PRC-017-0 as mandatory and enforceable. In addition, pursuant to section 215(d)(5) of the FPA and § 39.5(f) of our regulations, the Commission proposes to direct that NERC submit a modification to PRC-017-0 that: (1) includes a requirement that maintenance and testing of these special protection system programs must be carried out within a maximum allowable interval that is appropriate to the type of relaying used; and (2) identifies the impact of these special protection system programs on the reliability of the Bulk-Power System.

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## Other Activities Related to PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0

These four Standards are contained in several projects and draft SARs as part of the “Draft Reliability Standards Development Plan: 2007–2009”, which was approved by the NERC Board of Trustees.

The SPCTF recommends that standards PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0 be removed from the separate SANS in the Standards Development Plan, and that they be included in a new Standard Authorization Request for a single Protection System maintenance and testing standard.

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## Conclusions and Recommendations

PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0 require additions, clarifications, and definitions to insure that the Protection Systems are properly maintained and tested.

The SPCTF recommends that standards PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0 be removed from the separate SANS in the “Draft Reliability Standards Development Plan: 2007–2009,” and that they be included in a new Standard Authorization Request for a single Protection System maintenance and testing standard.

SPCTF submits the attached SAR for that purpose of consolidating PRC-005-1, PRC-008-0, PRC-011-0, and PRC-017-0 into a single standard to the Planning Committee for endorsement.



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