

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

Protection System Maintenance)
Reliability Standard)

Docket No. RM13-7-000

**INFORMATIONAL FILING OF THE
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION REGARDING
COMMISSIONING TESTING OF PROTECTION SYSTEMS**

The North American Electric Reliability Corporation (“NERC”)¹ hereby provides the Federal Energy Regulatory Commission (“FERC” or “Commission”) a report for informational purposes as directed in this proceeding on December 19, 2013. As described below, in Order No. 793,² the Commission accepted NERC’s commitment to keep the Commission informed on its progress on a variety of projects to examine the issue of commissioning testing of Protection Systems. NERC hereby provides the Commission with an accounting of NERC’s activities in this area during the past year since the issuance of Order No. 793. NERC will continue to remain engaged in the actions noted herein. NERC staff will keep Commission staff apprised on the progress of the Institute of Electrical and Electronics Engineers (“IEEE”) I25 working group, as noted below.

I. Notices and Communications

Notices and communications with respect to this filing may be addressed to the following:³

¹ The Federal Energy Regulatory Commission certified NERC as the electric reliability organization (“ERO”) in its order issued on July 20, 2006, in Docket No. RR06-1-000. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062 (2006).

² *Protection System Maintenance Reliability Standard*, Order No. 793, 145 FERC ¶ 61,253 at P 42 (2013).

³ Persons to be included on the Commission’s service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission’s regulations, 18 C.F.R. § 385.203 (2014), to allow the inclusion of more than two persons on the service list in this proceeding.

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II. Proceeding History

A. Notice of Proposed Rulemaking (“NOPR”) for Order No. 793

In the NOPR preceding Order No. 793, the Commission noted its concern that Reliability Standard PRC-005-2 does not include a requirement to verify that Protection System equipment and Components meet the same requirements specified for subsequent maintenance and testing in the PRC-005-2 Reliability Standard when those Components are first placed in service or are modified.⁴ The Commission requested comment on whether the Reliability Standard should be modified to address this concern.

B. NERC Comments in Response to NOPR

In its comments in response to the NOPR, NERC asked the Commission to refrain from issuing a directive until NERC can complete the on-going work described below and determine whether the actions have been sufficient to address commissioning testing.⁵ NERC also summarized its current activities to research whether a Reliability Standard governing commissioning testing programs should be developed. These actions, originally described in the NERC comments, are also included here for ease of reference.

⁴ *Protection System Maintenance Reliability Standard*, NOPR, 144 FERC ¶ 61,055 at P 28 (2013).

⁵ NERC Sept. 23, 2013 Comments at 4.

C. NERC Activity on Commissioning Testing of Protection Systems

On July 13, 2011, NERC's Event Analysis and Investigations Group submitted a Reliability Standard Suggestions Form⁶ to initiate a new standard development project to create a standard to address the testing of Protection System equipment before that equipment is placed into initial service.⁷ NERC's Event Analysis and Investigations Group provided an example of an event where an entity did not perform in-service testing as part of commissioning a new Protection System, resulting in line relays placed in service with the incorrect current transformer ratio. The defect remained undetected until the occurrence of a severe system disturbance when the relaying operated incorrectly, increasing the magnitude and scope of the disturbance.

The NERC Standards Committee identified the Reliability Standard suggestion as a possible new development project, but determined additional research was needed prior to initiating the project. On December 27, 2011, the Standards Committee issued a request for research asking for concurrence that a problem exists and requesting suggestions for addressing the issue. The Standards Committee requested that the Planning Committee research the issue.⁸ The Planning Committee assigned the System Protection and Control Subcommittee⁹ ("SPCS") responsibility for conducting the analysis. The *SPCS Response to Standards Committee Request*

⁶ Reliability Standard Suggestions Forms are submitted to suggest topics for the Reliability Standards Development Plan.

⁷ A copy of the Reliability Standard Suggestions Form is available in the materials posted for the March 6-7, 2012 NERC Planning Committee meeting. See Planning Committee Agenda, available at http://www.nerc.com/comm/PC/Agendas%20Highlights%20and%20Minutes%20DL/2012/1_March_2012_PC_Agenda_Finalv.pdf.

⁸ A copy of the request for research is available in the materials posted for the March 6-7, 2012 NERC Planning Committee meeting. See Planning Committee Agenda, available at http://www.nerc.com/comm/PC/Agendas%20Highlights%20and%20Minutes%20DL/2012/1_March_2012_PC_Agenda_Finalv.pdf.

⁹ The SPCS provides subject matter expertise related to Protection Systems and control. The purpose of the SPCS is purpose of the SPCS is to promote the reliable and efficient operation of the North American power system through technical excellence in Protection System and control system design, coordination, and practices. A roster of current SPCS members is available at http://www.nerc.com/comm/PC/System%20Protection%20and%20Control%20Subcommittee%20SPCS%20DL/Roster_Updated-08-17-10.pdf.

for Research (“SPCS Report”)¹⁰ was approved by the NERC Planning Committee on March 5, 2013.¹¹ A copy of the Reliability Standard Suggestions Form, Request for Research and the SPCS Report are included in NERC’s prior comments as Exhibit A.

In the SPCS Report, the SPCS recommends actions to reduce Protection System Misoperations through improved commissioning practices. The SPCS Report recommends, as an alternative to a standard, a series of reactive and proactive activities related to analysis of Misoperations, sharing of lessons learned, and development of an industry reference document on Protection System commissioning practices. The SPCS explained that inadequate or improper testing of Protection Systems during any time in the life cycle of a Protection System may lead to a future Misoperation. However, the SPCS noted that it considers Misoperations due to commissioning testing errors to be a relatively small subset of Misoperations overall, and often discovered upon initial energization. The SPCS also explained that the event cited in the Reliability Standard Suggestion Form is not typical because commissioning testing that includes in-service tests to verify current and potential circuits are properly connected is a common practice throughout the industry.

The SPCS Report noted that most entities have effective commissioning processes currently in place and that these processes are unlikely to be improved by a new reliability standard. The SPCS explained that a broad reliability standard with broad requirements to create and implement commissioning testing practices would introduce additional documentation burden without providing real guidance to entities for improving their processes. Conversely, a standard with detailed requirements prescribing how to commission Protection Systems would

¹⁰ *SPCS Response to Standards Committee Request for Research* (Mar. 5, 2013), available at http://www.nerc.com/docs/pc/spctf/SPCS%20Commissioning%20Testing%20Response_Final.pdf.

¹¹ See NERC Planning Committee Meeting Minutes, available at <http://www.nerc.com/comm/PC/Pages/AgendasHighlightsandMinutes-.aspx>.

undermine the various methods that entities have developed specific to their circumstances and could have an unintended, negative impact on reliability.

Rather than developing a new reliability standard, the SPCS suggested improving commissioning practices through (1) analysis of Protection System Misoperations; (2) sharing of lessons learned; and (3) development of an industry reference document on Protection System commissioning practices. Each of these areas is summarized below and includes updates on activities since the issuance of Order No. 793.

In Order No. 793, the Commission stated that while it remained concerned about the continued possibility of Misoperations resulting from a failure to properly verify the operability or settings of Protection System equipment upon being placed in service or modified, it would not issue its proposed directive and instead await NERC's report on its activities as committed in its comments.¹²

D. Summary of NERC Activity on SPCS Report Recommendations

1. Analysis of Protection System Misoperations

On the first SPCS suggested method of improvement, analysis of Misoperations is an ongoing obligation pursuant to Reliability Standards PRC-004-2.1a (Analysis and Mitigation of Transmission and Generation Protection System Misoperations) and PRC-003-1 (Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems). Since Order No. 793, NERC has completed development work to revise and improve the PRC-004 Reliability Standard. Proposed PRC-004-3 (Protection System Misoperation Identification and Correction) identifies and corrects causes of Misoperations of Protection Systems, ensuring that transmission and generation Protection System Misoperations are analyzed and mitigated.

¹² Order No. 793 at P 41.

Proposed PRC-004-3 and a separate “Request for Data or Information”¹³ prepared pursuant to Section 1600 of NERC’s Rules of Procedure and approved by the NERC Board of Trustees (“NERC Board”), provide the means to accomplish the continued systematic analysis and correction of Misoperations. The NERC Board adopted proposed Reliability Standard PRC-004-3 on August 14, 2014, replacing PRC-004-2.1a. The proposed Reliability Standard is currently pending approval with the Commission.¹⁴

2. “Lessons Learned” Publication

With respect to the second SPCS suggested method of improvement, on March 11, 2014, the SPCS published its *Lesson Learned: Verification of Alternating Current Quantities during Protection System Commissioning* (“Lesson”). This Lesson is included as Exhibit A to this filing. The purpose of a “lessons learned” document is to provide industry with technical and understandable information that assists them with maintaining the reliability of the Bulk-Power System. The goal of this Lesson is to convey to Generator Operators, Generator Owners, Transmission Owners, and Transmission Operators the importance of including installation tests and effective in-service tests in commissioning testing practices. The Lesson is intended to emphasize the importance of commissioning testing, and not to be an exhaustive discussion of all available techniques. The Lesson highlights that failure to employ effective commissioning testing practices can lead to Protection System Misoperations, which impact the reliability of the Bulk-Power System. The Lesson details a case where effective commissioning and testing practices were not implemented during the installation of a new transformer. The Lesson uses this case to recommend specific advice on effective commissioning testing. Specifically, the

¹³ This document is available at <http://www.nerc.com/pa/RAPA/Pages/Protection-System-Misoperations-Section-1600-Data-Request.aspx>.

¹⁴ See NERC Sept. 15, 2014 Petition in Commission Docket No. RD14-14-000

Lesson explains that effective commissioning testing includes not only installation tests, but also effective primary current tests and in-service voltage and current tests. Each of these types of tests is detailed in the document. Collectively, the various tests uncover potential shortcomings by essentially comparing known, proper circuitry with newly installed circuitry.

NERC uses a number of different methods to follow-up on the issuance of a Lessons Learned document. NERC distributes Lessons Learned to industry, advertises them on social media, presents them at NERC technical committee meetings, discusses them during site visits with entities when appropriate, conducts quarterly webinars to discuss the documents, and also collects and analyzes feedback submitted by users through the instructions in the Lesson Learned. NERC has received very positive feedback on the use of Lesson Learned documents. This Lesson regarding commissioning testing has and will have similar treatment as NERC conducts follow-up activity following its issuance.

3. *IEEE Working Group Report*

With regard to the third recommended improvement, SPCS recommended that the IEEE Power System Relaying Committee (“PSRC”) create the industry reference document on Protection System commissioning practices and proposed to submit a formal request upon approval of the SPCS report. The Chair of the SPCS issued this request to the IEEE Power System Relaying Committee on September 5, 2013.¹⁵

In May of 2013, the ITF25 task force reviewed the SPCS Report.¹⁶ The task force determined that IEEE Guide C37.233 *Guide for Power System Protection Testing* should be

¹⁵ A copy of the letter request is included as **Exhibit B**.

¹⁶ See Power System Relaying Committee of the IEEE Power and Energy Society – Minutes of the Meeting, May 16, 2013, available at http://www.pes-psrc.org/minutes/2013_May_Baltimore_MD_draft_2.0.pdf.

reviewed prior to the next meeting since this guide has a section on commissioning.¹⁷ It was also suggested that the group review proposed Reliability Standard PRC-005-2 before the next meeting. Several members volunteered to contribute outlines of commissioning practices at their companies and present for discussion at the group's next meeting in September of 2013.

A member of NERC staff and the SPCS vice chair attended the ITF25 meeting on September 11, 2013 and engaged the group in discussion. Phil Tatro and Phillip Winston representing the NERC System Protection and Control Subcommittee provided background information on the discussions at the SPCS that led to the request for IEEE/PSRC to create a document to provide guidance for the utility industry. The group also discussed IEEE Guide C37.333 *Guide for Power System Protection Testing*, which covers commissioning as well as other testing activities. There was a discussion of what should be included in commissioning and pitfalls that need to be addressed. Some attendees also presented outlines of what their respective companies review during commissioning. At the end of the discussions, it was the decision of the taskforce to request that a working group be created to more specifically address commissioning of Protection Systems. The ITF25 agreed that PSRC should form a working group to develop a report to the Relaying Practices Subcommittee specifically on Protection System commissioning.¹⁸

The task force developed a scope of work and purpose statement for the proposed working group – I25: Commissioning of Substation Protection and Control Devices. The I25 working group report will provide guidance in the commissioning of power system Protection

¹⁷ IEEE Guide for Power System Protection Testing, *IEEE Std C37.233-2009*, Dec. 11, 2009, available at <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5352213&isnumber=5352212> (sign in or purchase required for access).

¹⁸ See Power System Relaying Committee of the IEEE Power and Energy Society – Minutes of the Meeting, Sept. 12, 2013, available at http://www.pes-psrc.org/minutes/2013_Sept_Albuquerque_NM_draft_3.0.pdf.

Systems. The report will cover overall system testing procedures for generators, line, line reactors, transformers, capacitors, and special protection schemes. This report is intended for power system protection professionals. It will include a reference list of type tests for protective devices as well as overall protection scheme performance tests applicable for commissioning testing for the various types of protection schemes.

The Relay Practices Subcommittee approved formation of the working group at its meeting on September 12, 2013. The group was formally established in January 2014. I25 met for the first time on January 16, 2014.¹⁹ At this meeting, the assignment and the motivation for the assignment were reiterated. The group briefly reviewed those sections of C37.233 that specifically address commissioning tests. Assignments were made to review the entire guide and how it addresses commissioning testing of the five areas of a Protection System, identify gaps and address those gaps. I25 met for a second time on May 15, 2014.²⁰ At this meeting, the group continued its discussion of C37.233 and set a goal of creating an outline of the report at its next meeting.

The working group has set a tentative goal of a first draft of a report by its September 2015 meeting. NERC staff will remain engaged with the working group to follow-up on the SPCS Report recommendation. NERC staff will keep Commission staff apprised on the working group's progress.

¹⁹ See Power System Relaying Committee of the IEEE Power and Energy Society – Minutes of the Meeting, Jan. 16, 2014, available at http://www.pes-psrc.org/minutes/2014_Jan_New_Orleans_LA_draft_3.1.pdf.

²⁰ See Power System Relaying Committee of the IEEE Power and Energy Society – Minutes of the Meeting, May 15, 2014, available at http://www.pes-psrc.org/minutes/IEEE_PSRC_May-2014_Meeting_Minutes-Draft-1.pdf.

III. Conclusion

For the reasons set forth above, NERC respectfully requests that the Commission accept this informational filing as compliant with the Commission's directive in Order No. 793.

Respectfully submitted,

/s/ William H. Edwards

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Date: December 19, 2014

CERTIFICATE OF SERVICE

I hereby certify that I have served a copy of the foregoing document upon all parties listed on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, D.C. this 19th day of December, 2014.

/s/ William H. Edwards

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