STANDARDS COMMITTEE

MIDWEST RELIABILITY ORGANIZATION

STANDARD APPLICATION GUIDE

PRC-004-5 (I)

PROTECTION SYSTEM MISOPERATION IDENTIFICATION AND CORRECTION

VERSION 1.1

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Acknowledgement

This publication was developed by a SME Team from MRO member organizations within the MRO footprint. The development of SME Teams is an ongoing effort to produce unified application guides for MRO and its registered entities.

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TABLE OF CONTENTS

Introduction

North American Electric Reliability Corporation (NERC) Reliability Standard PRC-004-5(i) – **Protection System Misoperation Identification and Correction** requires applicable entities to determine whether the Protection System operated as designed or if a misoperation took place. This document provides guidance in the application of the standard related to the associated timelines and the development of the Corrective Action Plan (CAP). Additional guidance for reporting Protection System Operation due to the retirement of the fill-in-the blank Standard **PRC-003-1 – Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems** and Evidence retention is provided.

The industry requested guidance with three requirements in PRC-004-5(i):

- R2 and R3 have several coincident and overlapping milestones assigned to the entity sending notifications as well as to the entity receiving the notifications. The milestones are not consistent between the entity responsible for sending the notification and the entity that receives it. Guidance is also needed with respect to the reporting responsibilities relative to joint ownership with respect to which entity is responsible for providing the notification.
- Industry requested guidance with R5 related to the development of Corrective Action Plans.

Description of each version of PRC-004

Version	Enforcement Date	Description
2.1(i)a[1]	May 29, 2015 (Currently Enforced)	Project 2014-01 to clarify application of Requirements to BES dispersed power producing resources PRC-004-3
-4(i)	July 1, 2016	Applicability revision under Project 2014-01 to clarify application of Requirements to BES dispersed power producing resources. (i) Revision to VRF designations from "Medium" to "High" for Requirements R1 through R6, in compliance with the Federal Energy Regulatory Commission's directive in N. Am. Elec. Reliability Corp., 151 FERC ¶ 61,129 (2015)
-5(i)	April 2, 2017	Added UVLS to version 4(i)

Definitions

Composite Protection System: *The total complement of Protection System(s) that function collectively to protect an Element. Backup protection provided by a different Element's Protection System(s) is excluded.*

Corrective Action Plan: *A list of actions and an associated timetable for implementation to remedy a specific problem.*

MIDAS (Misoperation Information Data Analysis System): Database to report Misoperations directly to NERC. MIDAS replaced webCDMS on July 1, 2016.

Misoperation: *The failure of a Composite Protection System to operate as intended for protection purposes. Any of the following is a Misoperation:*

1. ***Failure to Trip – During Fault*** *– A failure of a Composite Protection System to operate for a Fault condition for which it is designed. The failure of a Protection System component is not a Misoperation as long as the performance of the Composite Protection System is correct.*

[1] A lowercase roman numeral in parentheses to the right of the version number indicates that a change has been approved to a standard, but the next version number in the sequence is in use or the change is only to Violation Risk Factors or Violation Severity Levels.

2. ***Failure to Trip – Other Than Fault*** *– A failure of a Composite Protection System to operate for a non-Fault condition for which it is designed, such as a power swing, undervoltage, overexcitation, or loss of excitation. The failure of a Protection System component is not a Misoperation as long as the performance of the Composite Protection System is correct.*

3. ***Slow Trip – During Fault*** *– A Composite Protection System operation that is slower than required for a Fault condition if the duration of its operating time resulted in the operation of at least one other Element's Composite Protection System.*

4. ***Slow Trip – Other Than Fault*** *– A Composite Protection System operation that is slower than required for a non-Fault condition, such as a power swing, undervoltage, overexcitation, or loss of excitation, if the duration of its operating time resulted in the operation of at least one other Element's Composite Protection System.*

5. ***Unnecessary Trip – During Fault*** *– An unnecessary Composite Protection System operation for a Fault condition on another Element.*

6. ***Unnecessary Trip – Other Than Fault*** *– An unnecessary Composite Protection System operation for a non-Fault condition. A Composite Protection System operation that is caused by personnel during on-site maintenance, testing, inspection, construction, or commissioning activities is not a Misoperation.*

Protection System:

- *Protective relays which respond to electrical quantities,*
- *Communications systems necessary for correct operation of protective functions,*
- *Voltage and current sensing devices providing inputs to protective relays,*
- *Station dc supply associated with protective functions (including batteries, battery chargers, and non-battery-based dc supply), and*
- *Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.*

Requirement R2: 120 Calendar Day Milestone

R2. *Each Transmission Owner, Generator Owner, and Distribution Provider that owns a BES interrupting device that operated shall, within 120 calendar days of the BES interrupting device operation, provide notification as described in Parts 2.1 and 2.2.*
[Violation Risk Factor: High][Time Horizon: Operations Assessment, Operations Planning]

2.1 *For a BES interrupting device operation by a Composite Protection System or by manual intervention in response to a Protection System failure to operate, notification of the operation shall be provided to the other owner(s) that share Misoperation identification responsibility for the Composite Protection System under the following circumstances:*

2.1.1 *The BES interrupting device owner shares the Composite Protection System ownership with any other owner; and*

2.1.2 *The BES interrupting device owner has determined that a Misoperation occurred or cannot rule out a Misoperation; and*

2.1.3 *The BES interrupting device owner has determined that its Protection System component(s) did not cause the BES interrupting device(s) operation or cannot determine whether its Protection System components caused the BES interrupting device(s) operation.*

2.2 *For a BES interrupting device operation by a Protection System component intended to operate as backup protection for a condition on another entity's BES Element, notification of the operation shall be provided to the other Protection System owner(s) for which that backup protection was provided.*

Who is required to notify protection system co-owners?
The owner(s) of the BES interrupting device that operated, within 120 calendar days of the BES device operation.

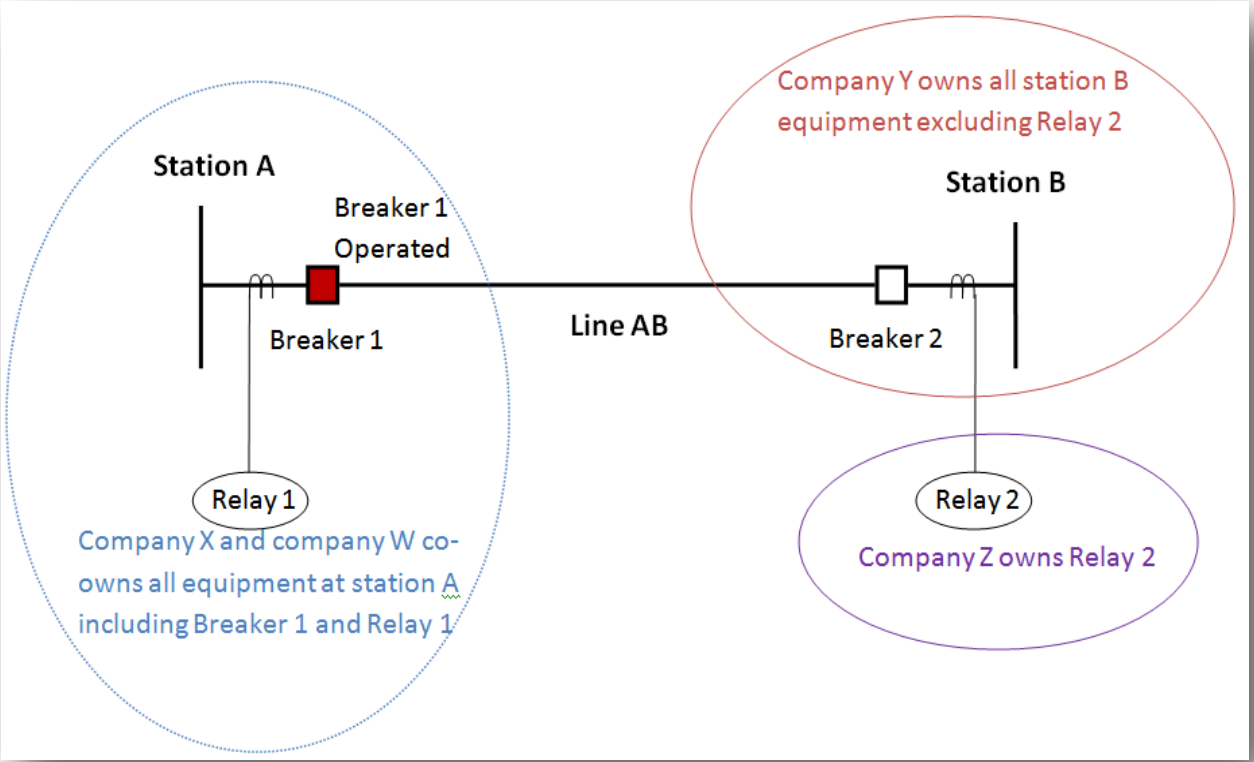

Figure 1.

Who does the owner(s) of the BES interrupting device need to notify?
All co-owner(s) of the Composite Protection System (i.e. relays, station dc supply, associated communication equipment, voltage sensing device and/or current sensing devices).

Example: In Figure 1 above, the protection system opened Breaker 1, therefore, condition of R2 Part 2.1.1 is met. If both conditions of R2 Part 2.1.2 and Part 2.1.3 are met, then as owners of Breaker 1, Company X and Company W are required to communicate to each other as co-owners of protection equipment at Substation A protecting the BES transmission Line AB.

Since the definition of a composite protection system includes the BES transmission Line AB protection system at Substation B. Company X and Company W are also required to notify that BES Breaker 1 operated to Company Y and Company Z as co-owners of protection equipment at Substation B.

When would the owner(s) of the BES interrupting device need to notify owners of associated Composite Protection Systems?

1. The owner of the BES interrupting device has determined, within 120 days of the event, a misoperation was not caused by its own Protection System; **or,**
2. If the owner of the BES interrupting device is unsure that the event was a misoperation, within 120 days of the event; **or,**
3. For events involving a Generator Owner and a Transmission Owner, the Generator Owner and the Transmission Owner must notify each other, within 120 days of the event, if its interrupting device operates due to a suspected misoperation, regardless if the Generator Owner and the Transmission Owner are within the same company, unless the same personnel identify misoperation for both the generator and transmission owners.

When would the owner of the BES interrupting device NOT need to notify owners of associated Composite Protection Systems?

1. The owner of the BES interrupting device has investigated the event and determined, within 120 days of the event, that its own Protection System component has caused the misoperation. Since R2 Part 2.1.3 is not satisfied, notification is not required but is recommended.
2. The owners of the Composite Protection System have determined, within 120 days of the event, that the event was a correct protection system operation. Since R2 Part 2.1.2 is not satisfied, notification is not required but is recommended.
3. The interrupting device that operated is not a BES interrupting device.

Requirement R3: 60 Calendar Day Milestone for the Protection System owner receiving notification

R3. *Each Transmission Owner, Generator Owner, and Distribution Provider that receives notification, pursuant to Requirement R2 shall, within the later of 60 calendar days of notification or 120 calendar days of the BES interrupting device(s) operation, identify whether its Protection System component(s) caused a Misoperation.*

Each Protection System owner must identify whether its Protection system component(s) caused a Misoperation.

- If the Protection System owner receives event notification within 60 days of the event date, R3 requires that the Protection System owner identifies whether its Protection system component(s) caused a Misoperation within 120 days of the event date.
- If the Protection System owner receives event notification more than 60 days after the event, R3 requires that the Protection System owner identifies whether its Protection system component(s) caused a Misoperation within 60 days of receiving a notification.

For evidence, entities are encouraged to record the date that it received event notification and the date that it determined whether the event was identified as a Misoperation or a correct operation.

Requirement R5 Corrective Action Plan (CAP)

R5. *Each Transmission Owner, Generator Owner, and Distribution Provider that owns the Protection System component(s) that caused the Misoperation shall, within 60 calendar days of first identifying a cause of the Misoperation:*

- *Develop a Corrective Action Plan (CAP) for the identified Protection System component(s), and an evaluation of the CAP's applicability to the entity's other Protection Systems including other locations;* ***or,***
- *Explain in a declaration why corrective actions are beyond the entity's control or would not improve BES reliability, and that no further corrective actions will be taken.*

60 calendar day Timeline for the Protection System Owner to Develop a CAP

Each responsible entity is required to develop a CAP or explain in a declaration that there is no need for a CAP within 60 days of first identifying a cause of the Misoperation. It may take several years for an entity to determine which component caused the Misoperation and how/why it misoperated.

For evidence, entities are encouraged to record the date that it first identified the cause of the Misoperation and the date that the CAP was developed or the declaration was made.

Recommended Practice in Communicating Misoperation Cause

Once an entity has determined the cause of the Misoperation of the protection equipment, there is no requirement to communicate its findings with other protection system co-owners. However, the SME team recommends communicating with other co-owners when an entity has determined a cause of a Misoperation. This communication can confirm the protection system co-owners are in agreement about the cause, eliminate the need for other co-owners to continue investigating the suspected misoperation, assist each co-owner in creating a CAP or declaration, and assure all co-owners that the correct data and information is reported within MIDAS.

Example: In Figure 1 on page 8, Company X and W's communication equipment at Substation A detects noise, loss of guard, and interprets a transfer trip from the remote end Substation B. Company X and W are required to notify the remote end protection system owner's (Company Y and Z), and comes to the conclusion that the remote owner was the cause of the misoperation.

Company Z (the remote end protection system owner) investigates and determines its equipment never sent a transfer trip, and comes to the conclusion that Company X and W's equipment incorrectly operated on loss of guard and therefore was the cause of the misoperation. Without additional communication between the co-owners, you can see the entities came up with the opposite conclusion as to the cause of the misoperation.

Similarly if an entity has developed a CAP or declaration, it is recommended it share that with all other co-owners of the Composite Protection System.

Corrective Action Plan

A CAP must include a list of actions to correct the problem, a timetable, and the date the CAP was developed. Requirement R6 requires the actions and/or timetable be updated until the CAP is completed.

A CAP action may be, but is not limited to, a change of settings, complete a protection system coordination study, investigate to determine if further actions are needed, a replacement of failed equipment, wiring or design change at facility or update a procedure with additional training on revised procedures, etc.

The entity has the latitude to include similar protection system components at other locations throughout its BES system within the CAP. This is another factor that may lead to a CAP that may take several years to complete. The entity may consider the CAP complete when the misoperation has been resolved for the component that misoperated in addition to any other actions identified in the CAP, even if the similar components at other locations are still being evaluated.

For additional guidance, it is recommended that entities review the examples of CAPs within the Guidelines and Technical Basis subsection Requirement 5 of the PRC-004-5 standard starting on page 31.

Declaration

The declaration of no need for a CAP must include a date of the declaration.

If a responsible entity has determined that there is no need for a CAP, it must make a declaration which may include but is not limited to: an engineering study, an engineering justification (i.e. justification based on a balance of security and dependability), a coordination study or a statement that a CAP will not improve the reliability. (e.g. If an entity experiences a misoperation during an N-3 event, it is acceptable for that entity to come to the conclusion that no CAP is needed since a coordination study determined the relays are coordinated for any single or double contingency.)

Protection System Operation data request and Reporting[2]

Due to the retirement of NERC Reliability Standard PRC-003-1 – **Regional Procedure for Analysis of Misoperations of Transmission and Generation Protection Systems** Protection System operations are now reported under NERC Rules of procedure Section 1600 Requests for Data or information.

NERC requests Protection System operation data via Section 1600 Requests for Data and Information. The owner of the protection system component(s) that caused the Misoperation should enter this data/information into MIDAS.

Implementation Plans

PRC-004-4(i)

PRC-004-4(i) goes into effect on 7/1/2016. Any misoperation that takes place prior to 7/1/2016 will adhere to requirements within version of PRC-004 that was in effect based on the event date.

PRC-004-5(i)

PRC-004-5(i) goes into effect on 4/2/2017, includes the addition of Undervoltage Load Shedding (UVLS) equipment.

Evidence Retention

Section C.1.2 of the Reliability Standard requires all compliance evidence should be retained for the entire audit cycle or a minimum of twelve calendar months following the completion of each Requirement, whichever is longer.

[2] PRC-003 is retired (as of 7/1/2016)

Revision History

Revision	Effective Date	Author(s)	Approver(s)	Summary of Changes
1.0	8/9/2016	SMET	MRO SC	Original Issue
1.1	3/21/2017	SMET	MRO SC	Clarification added page 11, paragraph 5

Appendix A – References

1. PRC-004-4(i) – Protection System Misoperation Identification and Correction
2. PRC-004-5(i) – Protection System Misoperation Identification and Correction
3. NERC Glossary of Terms used in NERC Reliability Standards (Published 7/13/16)
4. Bulk Electric System Definition Reference Document
5. Implementation Plan for Dispersed Generation Resources PRC-004-4(i)
6. NERC Rules of Procedure Section 1600- Requests for Data or Information
7. NERC Protection System Misoperations webpage
8. MIDAS Reference Materials:
    - Misoperation Data Submission Form
    - NERC Protection System Misoperation webpage: Workbook and User Guide
    - MIDAS Training for Reporting Entities