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STANDARDS COMMITTEE
MIDWEST RELIABILITY ORGANIZATION

APPLICATION GUIDANCE PRC-005-6

MRO Standards Committee SME Team

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Promoting RELIABILITY and Mitigating
RISKS to the Bulk Power System



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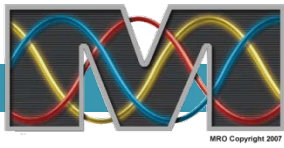
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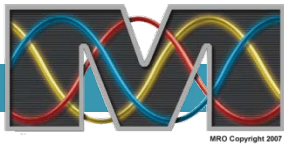
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Topics

- **Description of each version of PRC-005**
- **Distributed Generation Facilities**
- **Definitions**
- **Data Retention**
- **Facilities: Automatic Reclosing included or excluded**
- **Acceptable Maintenance Activities for Automatic Reclosing**
- **Acceptable Maintenance Activities for Sudden Pressure Relaying**
- **Implementation Plan for PRC-005-6**
- **References**



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Version	Enforcement Date	Description
-1	6/18/2007	Entity develop PSMP with activities and intervals for five component types. Action of protection considered.
-2	4/1/2015	NERC defines activities and intervals. Includes UVLS, UFLS, and SPS. Purpose of protection considered.
-2i	5/29/2015	Aggregate total BES Dispersed power resources > 75 MVA
-2ii	N/A, superseded by V6 implementation	SPS now RAS *
-3	N/A, superseded by V6 implementation	Added Automatic Reclosing
-3i	N/A, superseded by V6 implementation	Aggregate total BES Dispersed power resources > 75 MVA
-3ii	N/A, superseded by V6 implementation	SPS now RAS *
-4	N/A, superseded by V6 implementation	Added Sudden Pressure Relaying
-5	N/A, superseded by V6 implementation	Removal of required maintenance of dispersed generation
-6	1/1/16	Added Supervisory associated with Automatic reclosing. Combine implementation of versions -3, -4, -5, and -6.

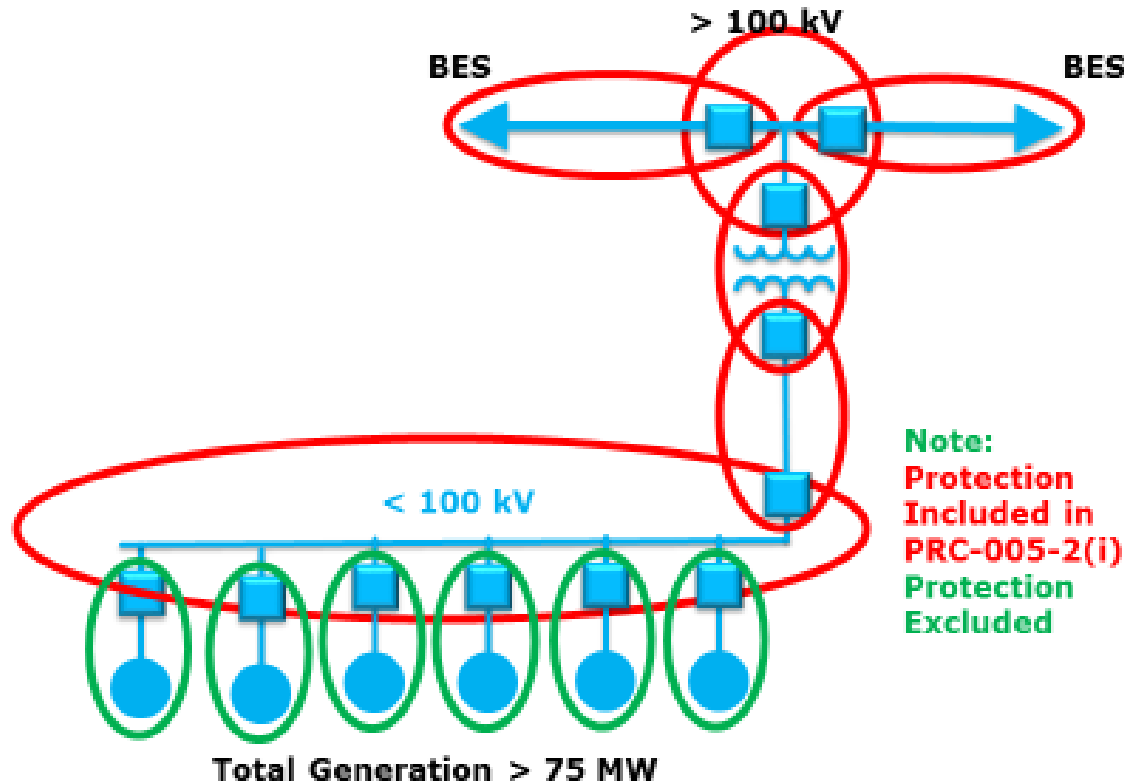


PRC-012-2 – Remedial Action Schemes

Note: Monitor the development of PRC-012-2 to coordinate any additional maintenance requirements which requires that a Remedial Action Scheme (RAS) be functional tested to verify the proper operation of all non-protection components.



Aggregated Generation > 75 MVA



8



Definitions Used in this Standard:

PRC-005-6 Automatic Reclosing – *Includes the following Components:*

- *Reclosing relay*
- *Supervisory relay(s) or function(s) – relay(s) or function(s) that perform voltage and/or sync check functions that enable or disable operation of the reclosing relay*
- *Voltage sensing devices associated with the supervisory relay(s) or function(s)*
- *Control circuitry associated with the reclosing relay or supervisory relay(s) or function(s)*



Definitions Used in this Standard:

Sudden Pressure Relaying – *A system that trips an interrupting device(s) to isolate the equipment it is monitoring and includes the following Components:*

- *Fault pressure relay – a mechanical relay or device that detects rapid changes in gas pressure, oil pressure, or oil flow that are indicative of Faults within liquid filled, wire-wound equipment*
- *Control circuitry associated with a fault pressure relay*



“Protection System Maintenance Program (PSMP)” Definition

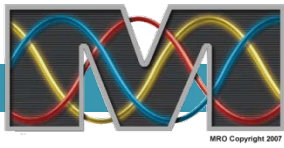
An ongoing program by which Protection System, Automatic Reclosing, and Sudden Pressure Components are kept in working order and proper operation of malfunctioning Components is restored. A maintenance program for a specific Component includes one or more of the following activities:



“Protection System Maintenance Program (PSMP)” Definition

- **Verify** — Determine that the Component is functioning correctly.
- **Monitor** — Observe the routine in-service operation of the Component.
- **Test** — Apply signals to a Component to observe functional performance or output behavior, or to diagnose problems.
- **Inspect** — Examine for signs of Component failure, reduced performance or degradation.
- **Calibrate** — Adjust the operating threshold or measurement accuracy of a measuring element to meet the intended performance requirement.

Source: [Glossary of Terms](#) used in NERC Reliability Standards.



Data Retention

Only the most recent performance records are required where the interval of the maintenance activity is longer than the audit cycle in PRC-005-6.

Note: For Components which have been removed from service, entities shall retain maintenance records for those Components until the new replacement component is maintained which may pre-date the prior audit. The minimum requirement for commissioning records of the replacement Component is the dates of the installation tests.



Automatic Reclosing Included

4.2.7.2 Automatic Reclosing applied on the terminals of all BES Elements at substations one bus away from generating plants specified in Section 4.2.7.1 when the substation is less than 10 circuit-miles from the generating plant substation.

4.2.7.3 Automatic Reclosing applied as an integral part of an RAS specified in Section 4.2.4.



Automatic Reclosing Excluded

- 1. Two buses away from generating plant where the total installed gross generating plant capacity is greater than the largest BES generating unit within the Balancing Authority Area regardless of the circuit miles.**
- 2. 10 circuit miles or greater from the generating plant.**
- 3. Synchronizing relays for breakers without auto reclosing relays.**

Note: A change from one bus to another bus would be determined by either 1) a change to a bus located on a separate ground grid or 2) transformation to another voltage.



Automatic Reclosing Excluded

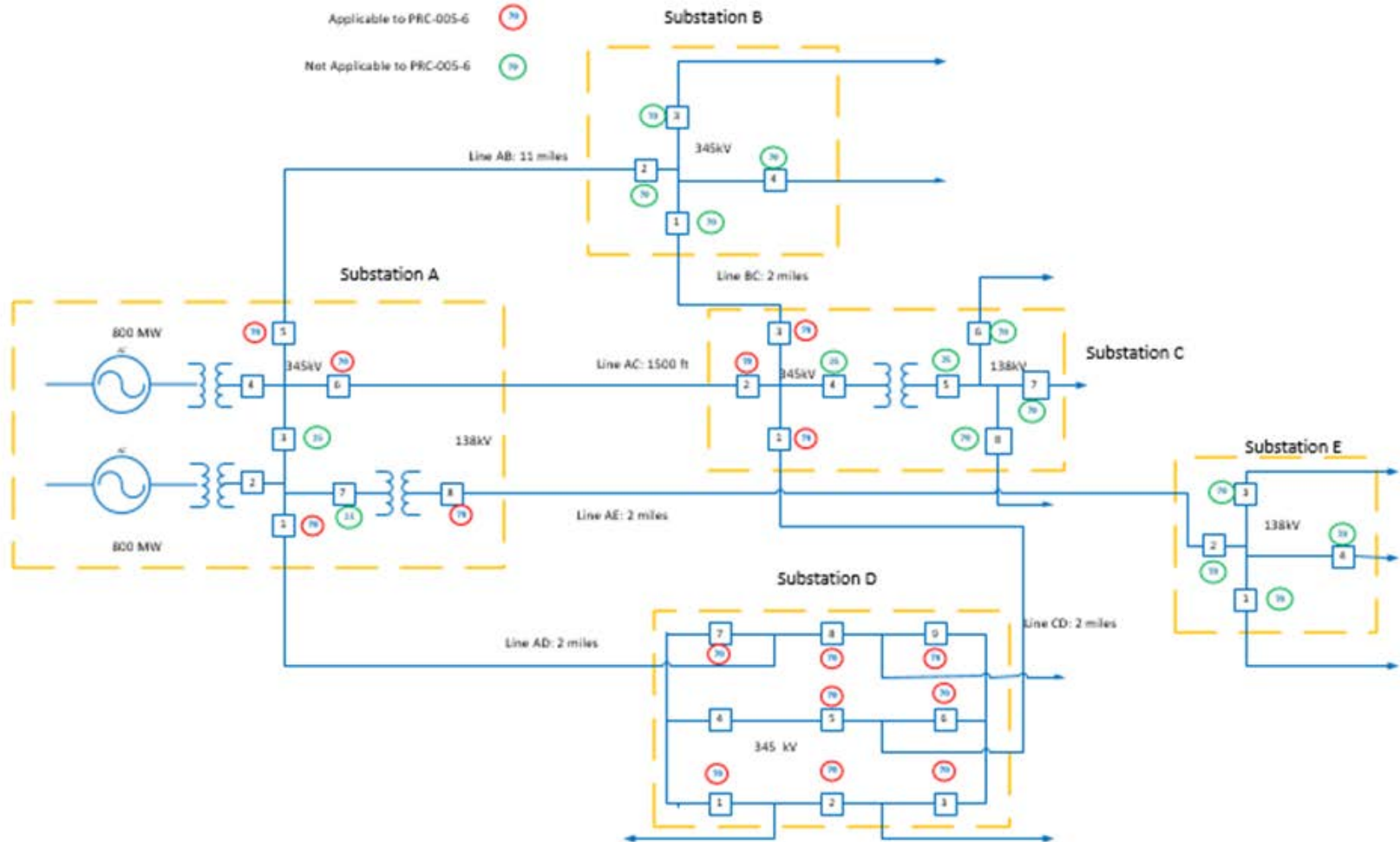
Automatic Reclosing addressed in Section 4.2.7.1 and 4.2.7.2 may be excluded if the equipment owner can demonstrate that a close-in three-phase fault present for twice the normal clearing time (capturing a minimum trip-close-trip time delay) still meets the critical clearing time for the generation.

- If both the trip-close-trip time delay and breaker failure time delay are shorter than critical clearing time, maintenance requirements for Automatic Reclosing can then be excluded.



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Maintenance Activities for Automatic Reclosing (Table 4-1)

Reclosing Relay and Supervisory Relay (Table 4-1)

Verify that settings are as specified

- A check box stating the relay settings were verified
- Pass/Fail or Yes/No/NA relays setting verification stated in relay test report

Section 15.8.1 of Frequently Asked Questions (FAQ) lists the supervisory relays that may be applicable (i.e. IEEE device 25, 27, and 59 relays associated with a 79).



Maintenance Activities for Automatic Reclosing (Table 4-1)

For non-microprocessor relays:

Test and, if necessary calibrate (only activity that requires more than a check box)

- **Relay test report**

- Date
- Relay identification
- Tester ID (not required, but is a good control)
- Test results proving the test was performed
- Pass/Fail-(not required, but is a good control)

Note: Relay calibration is not required to be documented, but this may be helpful for asset renewal



Maintenance Activities for Automatic Reclosing (Table 4-1)

For microprocessor relays:

Verify operation of the relay inputs and outputs that are essential to proper functioning of the Automatic Reclosing.

- A check box stating the essential relay outputs/inputs were verified
- Pass/Fail essential relay outputs/inputs verification stated in relay test report
- A check box stating the relay monitoring alarms were verified
- Pass/Fail essential relay monitoring alarm verification stated in relay test report

Note: Verify the actual operation of the output contact (i.e. test continuity at test switch or open breaker). Viewing an event report does not confirm the output actually closed; it only proves the logic to actuate the output picked up. Inputs can be confirmed via event reports.



Maintenance Activities for Automatic Reclosing (Table 4-3)

For microprocessor relays:

Verify acceptable measurement of power system input values.

- A check box stating during the PT testing, if there is another PT value to be compared to. (i.e. if you compare the energized system metered values within the primary relay to the secondary relay. This would satisfy both your AD convertor testing and PT testing.)
- A check box stating voltages measured by an independent meter were accurately measured within the relay.
- A check box stating known voltages were injected from a test set and verified to be accurately measured within the relay.
- A test report showing known voltages were injected from a test set and verified to be accurately measured within the relay.



Maintenance Activities for Automatic Reclosing (Table 4-1, 4-2a and 2b, and 4-3)

Automatic Reclosing Control Circuitry not integral part of RAS (Table 4-2a)

Microprocessor:

1. Confirm that the reclosing relay contact is open when that reclosing relay output logic is deactivated.

Note: The supervisory relay will not cause a premature closing command to the close circuitry.

Electromechanical:

1. Confirm that reclosing relay contact is open when that reclosing relay is deactivated.
2. Initiate a reclose and verify that the Automatic Reclosing does not issue a premature closing command to the close circuitry.



Maintenance Activities for Automatic Reclosing (Table 4-1, 4-2a and 2b, and 4-3)

Automatic Reclosing Control Circuitry for RAS schemes only (Table 4-2b)

Automatic Reclosing within a RAS (Table 4-2b):

1. A check box stating the verification of all Control Circuitry.
2. A check box stating each close coil or actuator is able to operate the circuit breaker or mitigating device.



Maintenance Activities for Automatic Reclosing (Table 4-1, 4-2a and 2b, and 4-3)

Automatic Reclosing Voltage Sensing Device (Table 4-3)

Automatic Reclosing Voltage Sensing Device maintenance activities are described in Table 4-3. All maintenance activities and documentation are the same as the protective relays voltage sensing devices. See Voltage and Current Sensing Devices providing inputs to Protective Relays (Table 1-3) section of the document.

Section 15.8.1 of Frequently Asked Questions (FAQ) lists the supervisory relays that may be applicable (i.e. IEEE device 25, 27, and 59 relays associated with a 79).



Maintenance Activities for Sudden Pressure Relaying (Table 5)

Fault pressure relay:

1) Check box stating verified the pressure or flow sensing mechanism is operable with a go/no go test.

- Westing house SPR- remove plug to actuate device per Westing house test procedure
- Bucholtz relay-push button to actuate the device
- Qualitrol Sudden Pressure Relief (SPR) – use Qualitrol test kit (hand pump and pressure gage) to actuate device
- Qualitrol Fault Pressure Relief (FPR) – reach in flip switch to actuate device, then manually reset
- Qualitrol Rapid Pressure Rise relay (RPR) – use Qualitrol test kit (hand pump and pressure gage) to actuate
- ABB Gas Detector Relay (GDR) – use pump to actuate device per ABB test procedure



Maintenance Activities for Sudden Pressure Relaying Control Circuitry (Table 5)

Any test below is acceptable:

- A check box stating the verification of any required maintenance activity of Control Circuitry
- Highlighted schematics or one-lines
- A detailed list of each trip path for a breaker, auxiliary relay, or LOR that is signed and dated



Maintenance Activities for Sudden Pressure Relaying Control Circuitry (Table 5)

- For lockout testing requires a functional trip. As an example, a test using a Fault Pressure Relay output and station battery DC to trip the LOR is adequate.
- Any breaker that is determined to be non-BES does not have to be tripped, even if it is tripped by a BES fault pressure that is considered included within PRC-005-6.

Note: Supplementary reference and FAQ Section 15.3



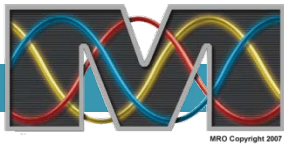
PRC-005-6 Implementation Plan

The Implementation Plan for PRC-005-6 includes all the Automatic Reclosing components introduced in PRC-005-3 and Sudden Pressure Relaying components introduced in PRC-005-4.



References

1. NERC Reliability Standard PRC-005-6 – System Protection Maintenance, Automatic Reclosing and Sudden Pressure Relaying
2. Supplementary reference and FAQ PRC-005-6 System Protection Maintenance
3. Bulk Electric System Reference Document
4. SMET test procedures



For Additional Clarification

Refer to MRO Standards Application Guide(SAG) posted on the MRO Website

Send your questions to msq@midwestreliability.org

Website: www.midwestreliability.org