



# Breaker Trip-Coil Energize Health Analytics

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# NERC PRC-005-6 Requirements

Standard PRC-005-6 – Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance

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## A. Introduction

1. **Title:** Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance
2. **Number:** PRC-005-6
3. **Purpose:** To document and implement programs for the maintenance of all Protection Systems, Automatic Reclosing, and Sudden Pressure Relaying affecting the reliability of the Bulk Electric System (BES) so that they are kept in working order.

The PSMP shall:

- 1.1. Identify which maintenance method (time-based, performance-based per PRC-005 Attachment A, or a combination) is used to address each Protection System Automatic Reclosing, and Sudden Pressure Relaying Component Type. All batteries associated with the station dc supply Component Type of a Protection System shall be included in a time-based program as described in Table 1-4 and Table 3.
- 1.2. Include the applicable monitored Component attributes applied to each Protection System, Automatic Reclosing, and Sudden Pressure Relaying Component Type consistent with the maintenance intervals specified in Tables 1-1 through 1-5, Table 2, Table 3, Table 4-1 through 4-3, and Table 5 where monitoring is used to extend the maintenance intervals beyond those specified for unmonitored Protection System, Automatic Reclosing, and Sudden Pressure Relaying Components.

# Moving from Time-Based to Performance-Based Maintenance

Table 1-5 Component Type - Control Circuitry Associated With Protective Functions Excluding distributed UFLS and distributed UVLS (see Table 3), Automatic Reclosing (see Table 4), and Sudden Pressure Relaying (see Table 5) Note: Table requirements apply to all Control Circuitry Components of Protection Systems, and RAS except as noted.		
Component Attributes	Maximum Maintenance Interval	Maintenance Activities
Trip coils or actuators of circuit breakers interrupting devices, or mitigating devices (regardless of any monitoring of the control circuitry).	6 Calendar Years	Verify that each trip coil is able to operate the circuit breaker, interrupting device, or mitigating device.

## PRC-005 — Attachment A

### Criteria for a Performance-Based Protection System Maintenance Program

**Purpose:** To establish a technical basis for initial and continued use of a performance-based Protection System Maintenance Program (PSMP).

# Install Split-Core Current Transducers to Provide Analog Signal to DFR

## Signals for Trip-Coil Analytics

- Analog Voltages from Bus or Line to which Breaker is Tied
- Analog Currents from Breaker
- Analog Current from Breaker Trip-Coil Circuit
- Digital Status of Breaker



# Breaker Trip-Coil Health Analytics

6 Breaker Operating Characteristics are Computed And Trended Over Time

- 1) P1 = Trip Initiate Time ( $\mu\text{s}$ )
- 2) P1 to P2 = Pickup Time ( $\mu\text{s}$ )
- 3) P1 to P3 = Trip Time ( $\mu\text{s}$ )
- 4) L1 = Maximum Pickup Amps
- 5) L2 = Maximum Trip Amps
- 6) Trip Coil Condition = Slope of Black Line (A/s)



