

**PJM RELAY SUBCOMMITTEE
RELAY TESTING AND MAINTENANCE PRACTICES**

Recommendations to comply with NERC PRC Reliability Standards

February 15, 2018

**PJM Interconnection
Relay Subcommittee
Relay Testing and Maintenance Practices**

I. Scope

This guideline is intended to cover all protective relays, relay communications equipment, and disturbance monitoring equipment associated with all transmission lines (as defined by each member utility) and associated facilities, all interconnection lines and facilities, all large (100MW and above) unit connected generators under automatic load control, and all other generators where failure may have an effect on the interconnection system. Protection systems are defined within the "PJM Manual 07 PJM Protection Standards". Each protection system owner is responsible for maintaining a program that identifies the protection systems that are subject to this guideline.

It should be recognized that these recommendations are intended to be a basis for maintenance planning and intervals can be extended in accordance with any NERC reliability standard. If a protection system owner's policy deems it beneficial, more frequent or more thorough testing may be performed.

II. Objective

The objective of a uniform time based Relay Testing and Maintenance program is to ensure the integrity of protection systems on a periodic basis after installation. Calibration testing is recommended to verify protective relay settings, identify any protective relay defects and adjust and correct accordingly. Functional testing is recommended to verify that the intent of the protection system is operational by identifying and correcting any protection system defects.

III. Frequency of Testing

In addition to installation testing, protection systems shall be periodically tested as follows:

Protection Systems	Calibration Test Frequency³	Functional Test Frequency³
Transmission Protection		
Electro-mechanical & Solid State	4 Years	4 Years
Microprocessor Based	N/A ¹	4 years
Generator Protection		
Electro-mechanical & Solid State	4 Years	4 Years
Microprocessor Based	N/A ¹	4 Years
Special Protection		
Electro-mechanical & Solid State	4 Years	4 Years
Microprocessor Based	N/A ¹	4 Years
Frequency / Voltage Load Shedding		
Electro-mechanical & Solid State	4 Years	4 Years
Microprocessor Based	N/A ¹	4-8 Years ⁴

III. Frequency of Testing (continued)

Protection Systems	Testing Frequency ³
Disturbance Monitoring Equipment Electro-mechanical, Solid State & Microprocessor Based Relay Communication Channels² - Power Line Carrier (PLC) - Tone - Microwave - Fiber Optic	8 Years 4 Years 4 Years 4 Years 4 Years

Notes:

- 1 - **Microprocessor based relays** - Periodic Calibration Testing does not apply. These relays are self monitoring. Regular retrieval and analysis of event records following system faults verifies operability. The analog metering, digital inputs, and outputs are verified with the Functional Test.
- 2 - **Testing of the relay communication channels** - Relay communication channels shall be tested on the same frequency as the protection system of which they are a part.
- 3- **Test Frequency** - Interval since last date tested, plus a 10% grace period (see "Documentation", below).
- 4- **Functional Testing Frequency**- When underfrequency or undervoltage (UF or UV) protection is part of line protection within a microprocessor relay for an individual circuit; the functional testing frequency is every 8 years. When a microprocessor relay with UF or UV protection is used to trip multiple circuits; the functional testing frequency is every 4 years.

IV. Procedure

The instruction and maintenance books issued by the equipment manufacturer and/or individual testing methods developed by the protection system owner should be used as the basic source of information in testing and maintaining protection systems. Industry experiences and manufacturer recommendations that point out deficiencies in relay and/or scheme designs may require unique test methods. It is important that these unique test requirements are incorporated into the protection system owner's testing program. Each protection system owner is responsible for maintaining a program that documents the general testing procedures to be used.

V. Documentation

Each protection system owner is responsible for maintaining a program that documents the frequency of testing, date last tested, and test results. However, in the event that testing was attempted within those intervals, but could not be completed due to circumstances beyond the control of the protection system owner, the contingency shall be documented, and a plan developed to complete the testing.

VI. Repairs and Replacements

Spare parts or complete replacements should be stocked or available, as appropriate. Manufacturer recommended spare parts list along with company utilization experience should influence the spare parts inventory. Availability of spare parts and utilization experience should be major factors in determining equipment repair and replacement.

All protective system trip operations should be analyzed for cause and if necessary corrective actions should be taken. Testing for cause is required in the event of an incorrect operation.

VII. Document Review Cycle

This document is to be reviewed at least every 4 years.

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