

PJM Compliance Bulletin

Protective Relay Information Provided to PJM Operators as required by NERC Standard TOP-006-1, Requirement 3

General

NERC Standard TOP-006-1 requirement 3 states that “Each Reliability Coordinator, Transmission Operator, and Balancing Authority shall provide appropriate technical information concerning protective relays to their operating personnel.”

PJM has identified information concerning protective relays which supports a level of knowledge adequate and appropriate for PJM system operators. PJM provides this information to its system operators through two routes: technical training and information available to the operator in the control room.

Technical training is conducted as a part of initial operator training, and is an annual requirement thereafter. Training completion is tracked using PJM’s Learning Management System. Transmission Owners are required to submit status changes to and outages of protective relays on equipment equal to, or greater than 345 kV, via the eDART system (PJM manual 3), and for certain protection system changes on equipment between 100 kV and 345 kV as summarized in the Discussion section below. PJM training educates operators to understand and react appropriately to eDART requests for changes and outages.

This compliance bulletin provides an outline of training topics provided by PJM to its operators.

Protective Relay Training Topics

1. Relay Applications
 - a. Basic Concepts in Protection
 - b. Overview of Power System Protection
 - c. Relay Devices
 - d. Relay Scheme Components
 - e. Relay Testing- Considerations and Concerns
 - f. General Considerations for Dispatchers Following A Relay Operation
2. General Protection

- a. Generator Unit Tripping
- b. Overall Unit Protection
3. Bus and Transformer Line Protection
 - a. Transformer Protection
 - b. Bus Protection
4. Transmission Line Protection
5. General System Protection
 - a. Relay Classification
 - b. Purpose & Function of Protective Relays
 - c. Sensitivity
 - d. Selectivity
 - e. Reliability
 - f. Power System Faults
 - g. Phase to Ground Faults
 - h. Phase to Phase Faults
 - i. Three Phase Faults
6. Special Protection Schemes

As well as the topics listed in this document, the training includes the history of protective relays, the theory of the technology, and the pro's & con's of the different relay schemes.

Discussion

PJM developed the training outlined above, to meet NERC CEH requirements; this training is periodically reviewed by PJM's training department employees, as well as operations personnel, and includes all topics and information necessary for system operators to effectively perform their jobs. Therefore this training meets and is compliant with the "appropriate technical information" threshold set forth in requirement 3 of NERC standard TOP-006-1.

Transmission Owners are required to report certain protective relay changes to PJM (PJM Manual 3), which gives operators a real time understanding of system operations and conditions. Specifically, "[a]n outage of either the primary or the backup relay protection associated with any EHV circuit 345 kV and above; **an outage of any other major relay**

protection scheme significant to EHV operation;.....All unplanned outages shall be communicated to PJM Dispatch and submitted via e-DART.” (PJM Manual 3, section 4.2).

The e-DART ticket is a standalone document which includes all information necessary to evaluate the outage. Changes to relay outages that go beyond the scope of the original e-DART ticket are not allowed. Any additional work must be evaluated under a new e-DART ticket and expressly approved by PJM before that work can begin.

Additionally, concerning BES facilities with no back up relay protection, Manual 3 states that the Transmission or Generation owner:

1. “[S]hould remove the facility from service, before removing the primary relay protection, when possible.”
2. “If the facility cannot be removed from service, the Transmission Owner or Generation Owner shall notify PJM dispatch verbally and through eDART of the impacted facility (s) and the remote fault clearing points. PJM Dispatch will modify the EMS Network Contingency analysis to reflect the remote clearing.”

The Transmission or Generation owner shall notify PJM of any instance where the SPS is unable to operate as designed.

Furthermore, Members are required by PJM Manual 3 Section 4.2 to notify PJM Dispatch of “any protection system failures or unavailability that impact the capability of protection relay systems on any facility on the list of Reportable facilities if such unavailability may result in a change in remote clearing, requiring PJM to modify PJM EMS Network Application Contingencies or switching the impacted facility out-of-s.” Member companies must indicate accurate reason codes on the eDART ticket. The choice of codes include “Relay Maintenance (No impact to primary clearing)” “Relay Maintenance (Impact to primary clearing)” “Relay Replacement (No Impact to primary clearing),” “Relay Replacement (Impact to primary clearing).”

Additionally, Transmission Owners must verbally communicate any change in status of a “Special Protection Scheme” to PJM Dispatch.

Conclusion

Training on protective relays gives operators the background and knowledge to understand and make appropriate changes to the EMS model based on system change information submitted. The combination of training and real time understanding of system status, constitutes “adequate technical knowledge,” as required by NERC standard TOP-006-1, requirement 3.

Document Retention

All evidence of compliance shall be retained in accordance with the document retention requirement as stated in the applicable NERC or Regional Reliability Standard. If there is no specific data retention requirement, the data will be retained for four years.

Development History

Revision: 0 Date: 12/22/2010	
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