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Title: "**Coordination of Generator Protection with Generator Excitation Control and Generator Capability**"

Author: **Charles J. Mozina**
Consultant–Beckwith Electric Company, Inc.

Contact: Carol Cohen
Consultant–Beckwith Electric Company, Inc.

Note: This paper won the 2008 PES Working Group Recognition Award for Technical Reports. A complete copy of this paper is available upon request.

Abstract:

Working Group J-5 of the IEEE Power System Relay Committee wrote this paper to provide guidance to the industry to better coordinate generator protection with generator control. Chuck Mozina, one of the authors, chaired this Working Group. The paper discusses specific calculation methods that can be used to ensure that generator protection and excitation system control are fully coordinated. It also specifically addresses the coordination of relays with generator full-load capability and machine stability limits. Because of recent blackouts, NERC (North American Electric Reliability Council) is developing standards for the coordination of generator protection and control. This paper provides practical guidance on providing this coordination.

The need to coordinate generator protection with generator control and load capability is not well known to protection engineers. These techniques, method and practices to provide this coordination are well established but scattered in various textbooks, papers and in relay manufacturers' literature. This paper provides a single document that can be used to address coordination of generator protection with generator control. It uses example calculations as its means of communicating these methods and also discusses steady-state stability and its impact on setting generator protection.

Because of recent misoperations of generator protection during major system disturbances, the need to improve coordination between generator protection and control has come to the forefront and NERC is now asking users to verify this coordination. This paper provides practical guidance for providing this coordination in the following specific protection areas:

- Generator Capability Curve Coordination
- Underexcited setting coordination with generator loss-of-field (40) protection

- Overexcited setting coordination with generator impedance (21) backup protection
- AVR Coordination - Underexcited Operation
- Coordination of the Under Excitation Limiter (UEL) with loss-of-field protection and Steady-State Stability Limits
- AVR Coordination – Overexcitation Operation
- Coordination of AVR V/Hz limiter with overexcitation (V/Hz) protection