

Western Interconnection Protection Practices

FERC Order 754 Protection System
Single Point of Failure Discussions

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WECC EHV Transmission Line Protection Guide

- Breaker failure relaying is not required to be redundant, but a breaker failure relay shall **NOT** be initiated from the same auxiliary relay that is used to trip the breaker.
- **The redundant systems should be designed to eliminate the possibility that a single protection system component failure can disable all applied systems.**
 - **At least two relay systems are required to achieve dependability** for transmission line protection based on NERC/WECC Planning Standards. Each system shall operate from separate AC current and potential secondary windings, have separately fused DC control voltages, and should have dual circuit breaker trip coils operated by separately fused DC sources.
- Components
 - The owner should **consider the impact of a single component failure** in microprocessor or static relays that implement multiple protection functions through common output contacts. Similarly, the owner may consider the possibility of common mode failure among relays, brought on by either similar operating principles or components.

WECC Standard PRC-004-WECC-1

- Addresses operating modes and reporting for misoperations of redundant and non-redundant Protection Schemes.
- Standard only applies to the major transmission paths
- Definition: Functional Equivalent Protection System (FEPS)
 - Different Protection Systems that can **detect the same faults** within the zone of protection **and provide the clearing times** and coordination needed to comply with all Reliability Standards.
 - Each Protection System may have different components and operating characteristics

- PG&E Guideline G13039
 - The protective relay scheme should be designed with sufficient redundancy or backup protection to ensure that a fault is cleared within a reasonable time, even if the primary protective relay fails to operate or if a breaker fails to trip.

- **PG&E 500kV Line Protection**

- At least three sets of relays are provided to protect each line.
- To assure protection in the event that a primary relay set fails, at least two sets of relays are required to be in service on every energized line...
- Each 500kV line has two independent direct transfer trip (DTT) channels, ... At least one transfer trip channel must be in service when the line is in service.