



Midwest Protection Practices

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The Midwest



Midwest System Voltage Levels

- **EHV (300kv Ph-Ph and above)**
 - 765kV (Eastern Midwest primarily)
 - 500kV (A few lines only)
 - 345kV (Prevalent, most predominant)
- **HV (below 300kV Ph-Ph)**
 - 230kV (NW Midwest only)
 - 115kV, 138kV, and 161kV (all utilized in specific areas)

Midwest Protection Practices

EHV Protection Design Practices

- Two local protection systems applied
 - First system is high-speed
 - Second system is employed to meet NERC performance requirements
 - Majority are high-speed as a standard
 - Each system typically uses separate relays, aux relays (if reqd.), CT windings, PT secondaries, communication channels, DC control circuits, and trip coils
- Local breaker failure applied
- Remote backup, if applied, is applied as a safety net only to minimize risk during extreme events beyond NERC criteria

Midwest Protection Practices

HV Protection Design Practices

- Use of one or two local protection systems
 - Two local protection systems applied
 - When required per NERC performance requirements
 - In areas where remote backup is impractical due to network topology (i.e. dense highly interconnected networks)
 - When modern systems with microprocessor relays are applied
 - May lack some redundant components present at EHV levels
 - CT wdgs., not available in older breakers
 - Redundant comm. ckts. are often not required
 - Single local protection systems applied
 - Some legacy Electromechanical or Solid State systems
 - Local and Remote backup applied to address NERC performance requirements
- Local breaker failure applied in vast majority of cases

Midwest Protection Practices

Regional Standards/Guidelines

- RFC utilizes legacy Regional Documents (ECAR, MAAC, & MAIN)
- ECAR Document 1 (listed as legacy on RFC website)
 - Standard 2: Individual systems shall be planned such that the network can be operated to supply projected demands and contracted firm transmission services with any single outage of a transmission line, transformer, special control device or generator due either to a forced outage or the failure of a primary protection device or special protection scheme.
 - Standard 5: Individual systems shall be planned such that the cascading shall not result from the condition of any single outage of a transmission line, transformer, special control device or generator due either to a forced outage or the failure of a primary protection device or special protection scheme, followed by a second single outage. Before or after the second contingency, the controlled interruption of demand, the planned removal of generators, manual intervention or curtailment of contracted firm power is committed.

Midwest Protection Practices

Regional Standards/Guidelines

- MAIN Guide 10 (Protection Principles and Guides)
 - States that Protection System Characteristics should generally include various characteristics including single contingency relay failure. Applies to all voltage levels.
- MRO no specific guides
- SPP Criteria 7.2 (Transmission Protection Systems, TPS)
 - States that TPS shall provide redundancy such that no single protection system component failure would prevent the interconnected transmission systems from meeting the system performance requirements of the NERC standards.
 - When redundancy required shall have separate ac current inputs, separately fused dc control voltage with new or upgraded TPS, dual circuit breaker trip coils considered, equipment and communications channel for each system separated physically and designed to minimize the risk of both protection systems being disabled simultaneously.