Coordination scheme for relay protection requirements

Overview

Relay Coordination Procedure: Guide to Power System ProtectionThis comprehensive guide explains the relay coordination process, key protection principles.

Key Takeaways

Relay protection coordination ensures that the protective device closest to a fault operates first, isolating only the affected section while upstream devices act as backups.Key Objectives of Relay Coordination

Relay coordination aims to:

• Ensure selectivity: Only the relay nearest to the fault trips, preventing unnecessary outages in other parts of the system .

• Protect personnel and equipment: Proper coordination reduces the risk of injury and limits damage to electrical equipment .

• Maintain service continuity: Minimizes the extent of service interruptions, improving reliability and operational efficiency .

• Comply with standards: Coordination must follow IEC standards (IEC 60255, IEC 60947) and ANSI numbering conventions for consistent operation across devices .
Coordination Principles
• Time-Current Grading: Relays are set with time delays so that the breaker closest to the fault opens first. Backup relays have additional time margins, typically 0.2–0.5 seconds, to account for breaker opening time and safety margins .

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• Current Grading: In radial systems, relays with lower pickup currents operate before those with higher settings, ensuring proper discrimination along feeders .

• Selectivity and Discrimination: Each relay must distinguish between faults in its own zone and faults in adjacent zones, preventing unnecessary tripping of upstream devices .

• Series Coordination: Relays in series should ideally have the same operating characteristics, with downstream relays set to operate faster than upstream relays .

• System Analysis Requirements: Coordination studies require single-line diagrams, transformer and feeder impedances, maximum and minimum fault currents, motor starting currents, transformer inrush characteristics, and CT performance curves .

Coordination Study Procedure

• Conduct load flow and short-circuit studies to determine fault currents and system behavior .

• Plot time-current characteristic curves for all protective devices on a common scale to identify miscoordination .

• Adjust relay settings to achieve minimum operating time for primary relays while ensuring backup relays operate only if the primary fails .

• Verify that all protective devices are sized according to the equipment they protect and that coordination meets safety and reliability requirements .

Practical Considerations

• Maintain grading margins between primary and backup relays to prevent simultaneous tripping.

• Consider transformer inrush, motor starting, and generator fault contributions when setting relay times.

• Regularly update coordination studies to reflect system changes, new equipment, or altered load conditions to ensure ongoing safety and reliability . By following these coordination requirements, power systems achieve selective, reliable, and safe operation, minimizing equipment damage, service interruptions, and safety hazards.

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