

Design of Relay Protection System for 35kV Substation

Article Overview

A 35kV substation relay protection system ensures rapid fault isolation, selective protection, and reliable operation through coordinated relays, CT/PT selection, and proper settings.

Key Principles of Relay Protection

Relay protection in a 35kV substation is designed to detect abnormal conditions and isolate only the faulted section to prevent equipment damage and maintain system stability. The main performance criteria include speed, selectivity, sensitivity, reliability, and security (). Relays must operate quickly to clear faults, detect even small or high-impedance faults, and avoid false trips during normal operation.

Components of the Protection System

- o Protective Relays: Act as decision-making devices, analyzing current and voltage signals to detect faults. Common types include overcurrent, differential, distance, and directional relays ().
- o Current Transformers (CTs): Reduce high system currents to standardized secondary currents for relay measurement. Proper CT ratio selection ensures accurate relay operation ().
- o Voltage Transformers (PTs): Step down system voltage to safe levels for relay input and measurement.
- o Circuit Breakers: Physically interrupt fault currents when commanded by relays, typically operating within 3 cycles ().
- o DC Battery Systems: Ensure relay operation during power loss.

Relay Protection Calculations

Designing a relay system requires precise calculations to determine relay thresholds and settings ():

- o Current and Voltage Sensing: Calculate maximum load current, minimum fault current, and voltage levels to set relay sensitivity.
- o Fault Level Calculations: Determine symmetrical and asymmetrical fault currents for single line-to-ground, line-to-line, and three-phase faults.
- o Time-Dial Settings: Configure overcurrent relays to coordinate with downstream devices and ensure proper fault clearing times.
- o Impedance Settings for Distance Protection: For line protection, calculate zone reach to cover designated line segments without overreaching.
- o Transformer Differential Settings: Set differential current thresholds, through-fault stability, inrush restraint, and harmonic filtering to prevent false tripping ().

Relay Settings and Coordination

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- o Primary and Secondary Ratios: Ensure CT and PT ratios match system parameters for accurate relay input ().
- o Overcurrent Relay Settings: Adjust pickup current and time delay to balance sensitivity and selectivity.
- o Coordination: Relays must be coordinated with upstream and downstream devices to isolate only the faulted section, avoiding unnecessary outages ().

Transformer and Busbar Protection

- o Differential Protection: Protects transformers and busbars by comparing incoming and outgoing currents. Sensitive to internal faults while stable for external faults ().
- o Thermal and Through-Fault Monitoring: Monitors transformer winding temperature and cumulative through-fault duty to schedule maintenance and prevent insulation damage ().
- o Directional Power Elements: Detect forward and reverse power flow to protect generators and transformers under various operating conditions.

Modern Considerations

- o Digital Relays: Offer multifunction protection, communication capabilities, and easier integration with SCADA systems.
- o System Subdivision: Divide protection zones for higher voltage levels to improve selectivity and reliability ().
- o Testing and Validation: Conduct thorough testing of relay settings and coordination to ensure proper operation under all fault scenarios.

Summary

Designing a relay protection system for a 35kV substation involves careful selection of relays, CTs, and PTs, precise calculation of fault currents and relay settings, coordination of protection zones, and monitoring of critical equipment. Proper implementation ensures rapid fault isolation, minimal service disruption, and long-term reliability of the substation ().

Explore the 35kV substation protective relays - AM5SE-F line protection devices. Featuring a modular

This paper made a design about a 35/10kV step-down substation according to the load of a town. The main technical focus is the

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(.pdf), Text File (.txt) or

This results in uniformity of design, coordinated interfaces and the same operating concept being established throughout, whether

This chapter first introduces the basic theories of power system relay protection, summarizes the functions and basic requirements of

Adding relay protection device in substation can send out fault signal and cut off fault line in time to reduce the

Click on the link below to watch the case study video "IEC 61850 Substation Modernization and Wire Reduction".

DESIGN CONSIDERATION Protection system adopted for securing protection and the protection scheme i.e. the coordinated

Primary substation in a power system There are different classifications of power substations, which might be used in

3.5 strengthen the relay setting value setting records management New equipment and put into operation or power

Previous chapters have detailed the make-up and operating characteristics of various types of protection relays. This

This article shall revolve around the design overview of switchgear and protection systems in a typical 132/33 kV

The most important role of protective relays is to first protect individuals, and second to protect equipment. Theoretically speaking, a

Protection Application Handbook Welcome to the Protection Application Handbook in the series of booklets within the LEC support

PDF | In China, the current use of box-type substation is widespread, all walks of life are in use, box-type substation,

Recommended References: IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus -

Web: <https://www.supremeacademicresearch.co.za>

