Calculation of 10kV Relay Protection Configuration

Article Overview

10kV relay protection settings are calculated by determining fault currents, selecting appropriate relay characteristics, setting impedance and time delays, and coordinating with upstream and downstream devices to ensure selectivity and reliability.

Step 1: Define Protection Philosophy

Before calculations, establish a protection philosophy for the 10kV network. This includes identifying the types of faults to protect against (phase, phase-to-ground), the priority of protection devices, and coordination with upstream and downstream relays . Clear guidelines ensure consistent and safe relay settings.

Step 2: Collect System Data

Gather all relevant system parameters:

o Line impedances (resistance and reactance)
o Transformer ratings and impedances
o Short-circuit currents (minimum and maximum)
o Load currents and expected operating conditions
o Tower footing and arc resistances for overhead lines

Step 3: Select Relay Type and Characteristics

Choose the appropriate relay type for the application:

o Overcurrent relays for feeder protection
o Distance relays for line protection
o Differential relays for transformers or busbars For distance relays, select impedance characteristics:
o Mho characteristic for phase faults (fast operation)
o Quadrilateral characteristic for phase-to-ground faults (better selectivity with zero-sequence compensation if needed),

Step 4: Calculate Zone Reaches

Set the reach of each protection zone:

o Zone 1: Typically 80-90% of the line impedance, instantaneous operation (no intentional delay)

o Zone 2: 100% of the protected line plus 50% of the shortest adjacent line, with a time delay to coordinate with Zone 1 of downstream lines
o Zone 3: Optional, for backup protection, covering longer sections with additional delay Include resistive components such as tower footing resistance and arc resistance in the impedance calculation.

Step 5: Determine Time Delays

Set time delays to ensure proper coordination:

o Zone 1: 0 s (instantaneous)
o Zone 2: Coordinated with downstream Zone 1 operating time plus breaker opening time
o Zone 3: Additional margin for backup protection

Step 6: Transformer Protection Settings

For transformer differential relays (e.g., SEL-787):

o Use per-unit TAP scaling to normalize secondary currents
o Ensure that the sum of incoming currents equals 1.0 per unit and outgoing currents equal -1.0 per unit
o Maintain TAP ratio limits (TAPmax/TAPmin <= 7.5) to ensure proper sensitivity

Step 7: Coordination and Verification

o Verify selectivity with upstream and downstream relays
o Check for overreach in ground fault elements
o Use short-circuit studies to confirm settings under minimum and maximum fault currents
o Adjust settings if hybrid circuits or parallel lines affect impedance

Step 8: Software Assistance

Modern utilities often use software tools for automated calculation and documentation:

o SARA (Setting Automation Relay Assistant) for line relays
o ADMO for managing relay settings and revisions
o PowerFactory or DIgSILENT for short-circuit calculations and scenario analysis These tools help reduce errors, maintain consistency, and facilitate updates when system parameters change.

Step 9: Testing and Commissioning

After calculation, perform relay testing using secondary injection or simulation to verify:

o Correct operation under fault conditions
o Proper coordination with other relays
o Compliance with protection philosophy and safety standards By following these steps, 10kV relay protection settings can be accurately calculated, coordinated, and maintained to ensure reliable and selective protection of the distribution network.

This document discusses distance protection relay setting calculations. It provides the following key points: 1. Distance protection

To determine stability voltage for through fault Vs" Voltage across the relay at IFS (VS) CT Resistance (RCT)

Transformer Protection Application Guide This guide focuses primarily on application of protective relays for the protection of power

Han, M. (2021) Relay protection setting calculation of 10 kV transmission line based on distribution network automation

Development of new methods of automated coordination of traditional step-type protection and multidimensional

By following calculations meticulously, engineers can ensure the optimal performance of the relay in differential

For two-terminal lines where the remote station is a ring bus or breaker-and-one-half scheme including breaker failure protection, set

The calculations are performed to determine appropriate relay settings that ensure protection and coordination within the power

With this Protection Relay Setting Calculator, you"ll be able to work out pickup current, time multiplier settings (TMS),

Effective relay protection in HV/MV substations requires a thorough approach encompassing calculations, precise

Hier sollte eine Beschreibung angezeigt werden, diese Seite lässt dies jedoch nicht zu.

Calculation of 10kV Relay Protection Configuration

The protective equipment (CBs, VTs, CTs, and relays) are connected together to enable closed-loop simulation, i.e., the trip signals

This technical report refers to the electrical protection of all 132kV switchgear. These settings may be re-evaluated during the

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

Then, the electrical engineering software is used to perform a more accurate setting calculation and protection coordination. Also, the

Abstract. This article deals with the issue of protective relays in terms of protecting high voltage lines. At the beginning of the article it

Web: https://www.in-au.co.za