

Principle of Discharge in High-Voltage Cable Trays

Article Overview

Discharge in high-voltage cable trays occurs when the electric field exceeds the insulation strength, leading to phenomena such as partial discharge, corona discharge, or arcing, which can degrade insulation and affect system reliability.

Understanding Electrical Discharge

High-voltage cable trays carry conductors that are insulated to prevent current leakage. When the electric field intensity around a conductor exceeds a critical threshold, the insulation may locally fail, causing a discharge. This can occur in three main forms:

- o Partial Discharge (PD): A localized dielectric breakdown within the insulation that does not completely bridge the conductors. PD often occurs in voids, cracks, or imperfections in the insulation and gradually deteriorates the material, potentially leading to full insulation failure if left unchecked. PD is a key indicator of insulation health and is measured according to IEC 60270, which defines the apparent charge of PD pulses and provides standardized test circuits for detection and monitoring .
- o Corona Discharge: This occurs when the electric field near a conductor ionizes the surrounding air, typically at sharp edges or points. It produces a visible bluish glow, audible hissing, and radio frequency noise. While corona does not immediately cause a complete breakdown, it can lead to power loss, ozone formation, and insulation degradation over time .
- o Arcing: A more severe form of discharge where a sustained electrical path forms between conductors. Arcing can cause immediate insulation damage and poses a significant safety hazard.

Factors Influencing Discharge in Cable Trays

- o Voltage Level: Higher voltages increase the likelihood of exceeding the dielectric strength of insulation.
- o Insulation Quality: Voids, cracks, or aging materials are more prone to partial discharge.
- o Tray Design: Sharp bends, conductor spacing, and proximity to grounded surfaces can concentrate electric fields, increasing discharge risk.
- o Environmental Conditions: Humidity, dust, and contaminants can lower the breakdown threshold of air or insulation.

Measurement and Mitigation

- o Monitoring: PD sensors and high-frequency detection systems are used to monitor discharges in cable trays.
- o Design Considerations: Proper conductor spacing, smooth insulation surfaces, and shielding reduce electric field concentrations.

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o Standards Compliance: Following IEC 60270 and other high-voltage design standards ensures reliable operation and safety .

Summary

The principle of discharge in high-voltage cable trays is based on the interaction between electric field intensity and insulation strength. Understanding and monitoring partial discharge, corona, and arcing are essential for maintaining insulation integrity, preventing failures, and ensuring the safe and efficient operation of high-voltage systems. Proper design, environmental control, and adherence to standards are key strategies to mitigate discharge risks.

The article explores the phenomenon of corona discharge in high-voltage transmission lines and outlines key

This paper remedies the lack of comparison between studies specifically addressing partial discharge (PD)

Partial discharge testing of cables can be online or offline for medium to high voltage power

Fast Discharge prevents Fire hazard actively discharged to prevent residual voltage. separate disconnection unit. power resistors

This blog post explores the intricacies of high voltage systems, their vital role in energy transmission,

Electrostatic discharge (ESD) is defined as "the rapid, spontaneous transfer of electrostatic charge induced by a high electrostatic

Outdoor control cables may require larger conductor size to compensate for voltage drop due to the relatively long distance between

2011 Code language: 392.18 (H) Marking. Cable trays containing conductors rated over 600 volts shall have a permanent, legible

In electrical engineering, partial discharge (PD) is a localized dielectric breakdown (DB) (which does not completely bridge the space

ABSTRACT This paper explores and updates the reader on the phenomenon of partial discharge in the context of

A practical guide to product selection and installation This guide for engineers and installers has been

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developed by ABB as a

Partial Discharge tends to occur on the rising edge of the voltage sine wave. As such, PD impulses tend to be synchronized to the

Partial discharges (PD) in high-voltage (HV) devices can be used as indicators of insulation deterioration, often

This investigation aims to identify the trends and patterns in the internal partial discharge (PD) occurrences in the

A partial discharge (PD) measuring system has been deployed in order to identify and measure PD in a high voltage

Learn the best practices for installing cables in trays. This guide covers essential steps,

Web: <https://in-au.co.za>

