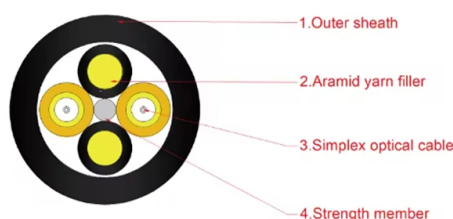


Eddy Current in Cable Trays



Overview

Ampacity of Power Cables Installed in Cable Trays Explore the factors affecting cable ampacity in trays, including thermal and electromagnetic effects. Lear.

Key Takeaways

Eddy currents in cable trays are circular currents induced in metallic trays by alternating magnetic fields from power cables, generating additional heat that can affect cable ampacity. How Eddy Currents Are Generated

Eddy currents occur when alternating currents in power cables produce changing magnetic fields, which induce circular currents in nearby conductive materials, such as galvanized steel or other metallic cable trays. These currents flow within the tray material and generate Joule heating, contributing to the overall thermal environment around the cables. The magnitude of these currents depends on the tray's material conductivity, magnetic permeability, and geometry, as well as the frequency and arrangement of the cables.

Effects on Cable Ampacity

The heat generated by eddy currents can increase the temperature of the cable tray, which in turn affects the ampacity of the cables. While for typical trays the additional heat is usually small compared to the cable conductor losses, improper cable arrangement or phase sequence can lead to significant localized heating, sometimes reaching temperatures around 70°C. This is particularly critical for magnetic metal trays, where the combination of eddy currents and magnetic hysteresis can exacerbate heating.

Mitigation Strategies

- **Cable Arrangement:** Three-phase power cables should be arranged in flat or trefoil configurations to minimize asymmetric magnetic flux and reduce induced eddy currents .
- **Tray Material Selection:** Using non-magnetic or low-conductivity materials can reduce eddy current formation.
- **Phase Sequencing:** Proper sequencing of phases ensures balanced magnetic fields, reducing the risk of excessive tray heating .
- **Tray Design:** Open trays with good airflow improve heat dissipation, while laminated or segmented metallic trays can limit eddy current loops.
- **Thermal Analysis:** Software tools or finite element analysis (FEA) can model eddy current effects and optimize cable and tray design for high-current installations .

Practical Considerations

- For single or split cable sets, eddy currents between separate steel frames are generally minimal if the currents are balanced, but slight imbalances can occur due to unequal paths .
- In high-power or high-frequency applications, careful design and monitoring are essential to prevent overheating and maintain cable performance.
- Standards and guidelines provide derating factors for cables in trays, accounting for heat transfer, proximity effects, and eddy current losses . Understanding and managing eddy currents in cable trays is crucial for safe, efficient, and reliable power distribution, especially in industrial or high-capacity installations. Proper cable layout, tray material choice, and thermal analysis are key to minimizing their impact.

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After the testing with load (nearly 200 amps), all wires, cable trays, and grounding terminals are good and are now

A Review of Medium Voltage Single-Core Cable Armouring,

This is because a mag-netic field is produced by the current which induces an electric current (eddy currents) in any ferromagnetic

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Single Conductor Cable Installation Guide

1) Installing single conductor cables requires preventing eddy currents in surrounding steel and circulating currents in armored layers.

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Single-Conductor Issues – IAEI Magazine

The same magnetic fields that surround single-conductor cables also produce eddy currents in the steel enclosures

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