Vibration Principle of Cable Tray Hangers



Overview

When the support becomes loose, the tray starts to bounce. This movement rubs the cables against the metal edges.

Key Takeaways

Cable tray hangers are prone to vibration from machinery, seismic activity, or structural motion, and proper isolation and bracing are essential to prevent damage and maintain system integrity.

Causes of Vibration

Cable tray hangers can experience vibration due to mechanical equipment, motors, fans, or seismic events. In industrial environments, harmonic resonance and continuous shaking can loosen bolts and fasteners, causing trays to bounce and cables to rub against metal edges, potentially damaging insulation and creating safety hazards. Seismic activity can also induce motion in suspended trays, requiring specialized bracing.

Effects of Vibration

Uncontrolled vibration can lead to: Loosening of bolts and nuts, which is a primary cause of support failure. Fatigue and cracking of tray materials, especially in high-frequency vibration zones. Damage to cables, including insulation wear and potential electrical hazards.

Increased maintenance costs and potential downtime due to repeated failures.

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Mitigation Strategies

Flexible and Damped HangersIntroducing flexible elements or vibration isolation hangers between the support and the tray can significantly reduce transmitted motion. Properly designed stiffness and damping characteristics allow trays to move slightly without transferring damaging forces to the cables. Spring-based vibration mounts are commonly used to isolate trays from structural vibrations.

Material Selection

Choosing materials with natural damping properties helps absorb vibration energy. Wire mesh trays or trays with inherent flexibility can reduce stress on cables and supports. Heavy-duty materials with fatigue resistance are recommended in high-vibration or chemical processing environments.

Seismic Bracing

For areas prone to earthquakes, cable bracing or rigid bracing systems can stabilize trays. Cable bracing works in tension and requires opposing braces, while rigid bracing handles both tension and compression but may be limited by drop length. Pre-engineered seismic bracing solutions, such as Eaton's B-Line series, provide tested assemblies for vibration and seismic control.

Hardware and Maintenance

Using locking hardware, vibration-resistant fasteners, and regular inspections ensures that supports remain secure. Approximately 70% of support failures occur due to loose nuts rather than material failure, highlighting the importance of proper fastening. Routine checks and torque verification are essential in high-vibration environments.

Best Practices

Combine flexible hangers with seismic bracing for maximum protection. Select materials and tray types suited to vibration frequency and amplitude. Implement preventive maintenance schedules to inspect and tighten supports.

Consider full-scale testing for critical installations to validate vibration isolation performance. By integrating these strategies, cable tray systems can maintain structural integrity, protect cables, and reduce maintenance costs in environments subject to vibration.

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Article Content

Vibration Isolation of Cable Tray Hangers

It was found that, for appropriate stiffness and damping characteristics, this concept could be used effectively to isolate cable trays from hanger motion caused by seismic excitation and to significantly

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How to Secure Cable Trays in High-Vibration

When the support becomes loose, the tray starts to bounce. This movement rubs the cables against the metal edges. This rubbing can wear

Feasibility study: a new cable-tray hanger concept for nuclear power ...

This study partially assessed the feasibility of using flexible connectors in Class 1E systems to attach cable trays to their stiff hanger systems.

Theoretical analysis, simulation, and field experiment for vibration ...

To increase the suspender cables/hangers'' damping ratio as well as control their vibrations, and also to make the mechanical damper cheaper and easier to be maintained, it is

Reduction of seismic loads in cable tray hangers

A study has been conducted to partially assess the feasibility of using flexible rather than rigid support systems for carrying electrical and control cables in nuclear power plants.

Theoretical analysis, simulation, and field experiment for vibration ...

Abstract Suspender cables/hangers occupy a crucial role during the whole service life of suspension bridges/arch bridges/space structures, and their long-term repeated vibration under

Cable Tray Technical Guide A practical guide to product selection and ...

In designing supports for a cable tray system, consideration should be given to the loads associated with future cable additions and any additional loading that may be applied to the cable tray system (e.g.,

Field monitoring and control for vortex-induced vibration of hanger ...

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Invented two types of arrayed tuned mass dampers to suppress VIVs of hanger cables. This study aims to investigate the vortex-induced vibrations (VIVs) characteristics of hanger cables in

GUIDE CABLE TRAYS TECHNICAL

NEMA VE 1-2017 Specifies requirements for metal cable trays and associated fittings designed for use in accordance with the rules of Canadian Electrical Code, Part I and the National Electrical Code®

Reduction of seismic loads in cable tray hangers

Practical/ fission reactor safety nuclear power stations/ electrical cables seismic loads cable tray hangers rigid support systems control cables nuclear power plants flexible hanger design hanger vibration

Cable Tray Technical Guide A practical guide to product selection and ...

Cable Tray Technical Guide A practical guide to product selection and installation This guide for engineers and installers has been developed by ABB as a practical reference regarding cable tray

Guide to cable support systems

A cable support system consists of cable support lengths and system components, such as cable support fittings, support elements, mounting elements and system acces-sories. The cable support

Test-based approach to cable tray support system analysis and

Several utilities initiated extensive test programs, which demonstrated that trapeze strut-type cable tray support systems exhibited inelastic and nonlinear response behaviors with plastic

Dynamic modeling and analysis of hanger cables with spacers and

Abstract Many suspension bridges are designed with hangers composed of pairs of cables. The hanger cables are featured by low fundamental frequencies and extremely low inherent

Seismic fragility analysis of suspended cable trays in civil buildings ...

This study aims to understand the seismic fragility of typical suspended cable trays in civil buildings through full-scale shaking table tests and numerical simulation. Based on the shaking table

Performance-based earthquake engineering methodology for seismic ...

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On account of limited experimental and analytical studies, the seismic performance of the cable trays is questionable ; and . In the 1984 Morgan Hill, California Earthquake, a cable tray run at the

Seismic performance sensitivity analysis to random variables for cable ...

The final results demonstrate the need to consider the effects of random variables in modeling assumption in seismic performance analyses of cable tray and can be further used in

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