

Article Overview

Busbar joints overheat primarily due to increased contact resistance caused by oxidation, contamination, improper installation, and mechanical stress.

Contact Resistance

The most common cause of busbar joint overheating is high contact resistance. Even small increases in resistance at the joint generate significant heat according to Joule's law ($P = I^2 \times R$) when high currents flow through the busbar. Factors contributing to elevated contact resistance include:

- o Oxidation and Surface Contamination: Copper busbars naturally form resistive oxide layers (CuO/Cu₂O) when exposed to air. Dust, oils, hand sweat, and chemical residues can further reduce conductivity, creating localized heating.
- o Improper Installation: Under-tightened bolts or uneven torque distribution reduce contact pressure, increasing resistance. Multi-bolt joints require sequential tightening (e.g., star pattern) to ensure uniform pressure.
- o Incorrect Fastener Material: Using bolts with lower conductivity than copper, such as steel, can increase resistance and heat generation.

Mechanical Stress and Thermal Expansion

Busbars expand when heated, and repeated thermal cycling can introduce mechanical stress at joints. Rigid copper busbars have limited tolerance for movement, so thermal expansion and contraction can gradually loosen connections, increasing contact resistance and causing localized overheating. Cyclic loading from fluctuating currents exacerbates this effect, potentially raising temperatures above 150°C and accelerating oxidation or insulation damage.

Design and Load Factors

- o Undersized Busbars: If the busbar cross-section is too small for the current, it can overheat.
- o Uneven Current Distribution: Improper design or connection layout can cause certain joints to carry more current than others, leading to hotspots.
- o Long-Term Degradation: Even well-installed joints can degrade over time due to mechanical fatigue, vibration, or repeated thermal cycling, increasing the risk of overheating.

Preventive Measures

- o Use properly sized busbars and high-conductivity materials.

Overheating of busbar joints

- o Apply correct torque during installation and periodically check bolted joints.
- o Clean surfaces and use anti-oxidation coatings like tin plating or silver spray.
- o Consider flexible busbar connectors in high-current or thermally dynamic systems to relieve mechanical stress .
- o Monitor joints with infrared thermography or embedded sensors to detect hotspots early . By addressing these factors, engineers can significantly reduce the risk of busbar joint overheating, improve system reliability, and prevent costly downtime or equipment damage.

Overheating causes greater electrical resistance, which raises the possibility of operational shutdown due

"Temperature Monitoring Solutions for Early Detection of Abnormal Overheating in Bus Ducts (Bus bars)" >

Abnormal temperature increases detected through thermal imaging, visible corrosion or discoloration, loose joints, unusual odors,

a large number of joints due to its limited length, and thus it is prone to overheating fail-ure caused by poor contact. Taking the

However, busbar products often encounter issues such as overheating, corrosion, mechanical wear, and poor electrical connectivity.

Learn why copper busbar joints can overheat even when current stays stable. Understand contact resistance, copper

1. Loose Electrical Connections Loose or improperly tightened electrical connections are the

The fully insulated busbar system, which has been extensively used in the industry, contains a large number of joints

Why do copper busbars overheat and melt? Learn the real engineering causes, when rigid busbars fail, and how

Copper busbars, known for their excellent electrical conductivity and mechanical strength,

Efficient joints in copper busbar conductors can be made very simply by bolting, clamping, riveting, soldering or

Based on engineering insights, the primary causes of busbar failures, exploring their technical principles,

Overheating of busbar joints

Quick Answer Why do busbar bolts heat up? Busbar bolts heat up due to increased electrical resistance caused by

Understand AC busbar thermal derating to prevent panel overheating. This guide covers sizing math, enclosure

This paper is focused on hybrid busbars made from aluminum and copper with the purpose

When the contact resistance in the busbar joint area increases, the heat pipe structure decreases the maximum

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