

Selection of Low-voltage Main Busbar



Overview

Design busbars for equal current sharing, low voltage drop, and scalability. Includes sizing, material selection, and thermal considerations.

Key Takeaways

Selecting a low-voltage busbar requires careful consideration of current rating, material, thermal limits, short-circuit capacity, and IEC 61439 compliance. Key Considerations for Busbar Selection¹.

Current Rating and Cross-

Sectional Area Busbars must carry the continuous current of the system without exceeding permissible temperature rise. The cross-sectional area is determined using the formula $A = I / J$, where I is the required current and J is the current density (typically 1.5-2.

5 A/mm² for copper in enclosed environments). Undersized busbars can overheat, cause insulation failure, and reduce equipment life, while oversized busbars increase cost unnecessarily. 2.

Material Choice

Copper: High conductivity (~100% IACS), compact layouts, strong mechanical behavior, good corrosion resistance. Preferred for compact panels and high joint stability. Aluminum: Lower conductivity (~61% IACS), requires larger cross-section, lighter weight, suitable for large panels or long conductor runs.

Surface finish (bare, tin-plated, silver-plated) affects contact resistance and oxidation control, especially at terminations. 3.

Thermal Performance and Temperature Rise IE

C 61439 specifies maximum temperature rise limits for busbars under continuous load. The upper safe temperature limit is typically 140°C (105 K above ambient 35°C). Proper sizing ensures the busbar operates within thermal limits, preventing hotspots and deformation.

4.

Short-

Circuit Withstand and Mechanical Strength Busbars must withstand prospective short-circuit currents without mechanical failure. Design must consider fault forces, joint quality, and panel geometry, as enclosure layout affects thermal and mechanical behavior. 5.

Layout and Symmetry Busbar arrangement affects current distribution, heat dissipation, and serviceability. Symmetrical layouts in multi-branch systems prevent uneven current sharing and hotspots at studs or terminations. Horizontal or vertical placement within compartments influences heat flow and future expansion.

6. Compliance with IEC 61439 IEC 61439-1 and -2 govern low-voltage switchgear and controlgear assemblies up to 1000 V AC and 1500 V DC. Compliance ensures verified assembly performance, including temperature rise, dielectric strength, clearances, creepage, and short-circuit withstand capability.

Verification must be performed on the complete assembly, not just individual busbars. 7.

Additional Factors

Diversity Factor: Adjusts busbar sizing based on expected load diversity.

Corrosion Resistance and EM

C: Important for long-term reliability and electromagnetic compatibility. Ease of Maintenance and Expansion: Proper busbar design supports scalability and cleaner protection coordination.

Summary

Selecting a low-voltage busbar involves balancing current-carrying capacity, material, thermal limits, short-circuit strength, and layout, while ensuring IEC 61439 compliance. Copper is preferred for compact, high-performance panels, while aluminum is suitable for larger or weight-sensitive installations. Proper sizing, surface treatment, and symmetrical layout are critical to prevent overheating, ensure safety, and maintain long-term reliability.

Article Content

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IEC 61439 Busbar Standard: A Guide to Low-Voltage Busbar

This standard covers busbars used for low-voltage assemblies, power distribution, photovoltaic power systems, and electrical energy control. The IEC 61439 busbar standard also

Selection and dimensioning of the main busbar system

The decisive criteria for selection of a main busbar system After selecting a busbar system, it is necessary to check are: that the other criteria for the busbar system are also met,

IEC Standard For Busbar Sizing: Complete Guide To

It ensures that busbars are correctly dimensioned to handle rated loads and withstand fault conditions without failure. Following this standard

Low Voltage Switchboard: Design, Ratings, and

Practical guide to low voltage switchboards—bus ratings, fault duty, protection, and applications—with a link to Enwei LV switchgear.

Switchboard Busbar Guide (2025): Design & Standards

Learn how switchboard busbars are designed, sized, and verified to IEC/UL. Compare Cu vs Al, spacing, and testing. Download the RFQ checklist.

Busbar Selection in Main Distribution Boards — Grokipedia

For instance, in low-voltage main distribution boards, busbars are often mounted on epoxy insulators spaced at intervals that distribute mechanical loads evenly, ensuring compliance during PEN splitting

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This article delves into the intricate processes behind busbar fabrication, detailing the techniques and tools necessary for efficient assembly.

Busbars: Electrical Types, Sizing & Design Guide

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Switchboard

IEC 61439 "Low-voltage switchgear and controlgear assemblies", specifies standard arrangements of switchboard (call forms of internal separation). The are labelled as Form 1, Form 2,

Twenty Switchgear Design Flaws That Drive Operators Crazy

I worked twelve years at Schneider Electric in the position of technical support for low- and medium-voltage projects and the design of busbar trunking systems. I'm highly specialized in the

Common Busbar Failures: Causes, Diagnosis Methods & Proven

Frequently Asked Questions—Common Busbar Failures What is the most frequently reported type of busbar failure? Loose connections, improper torque, undersized busbars, or high contact resistance

Busbar Design Standards for MV Switchgear

Busbar design within Medium Voltage (MV) switchgear is a critical aspect, fundamentally ensuring the safe, reliable, and efficient operation of

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