

How to select a 10kV busbar

Article Overview

Selecting a 10 kV busbar requires careful consideration of current rating, material, cross-sectional area, thermal limits, short-circuit withstand, and IEC compliance.

Material Selection

Busbars are typically made of copper or aluminum. Copper offers higher conductivity, smaller cross-section for the same current, and better thermal performance, but is heavier and more expensive. Aluminum is lighter and cheaper, but requires a larger cross-sectional area to carry the same current safely. The choice depends on space constraints, cost, and mechanical requirements.

Current Rating and Cross-Section

The continuous current rating determines the minimum cross-sectional area. For copper busbars, IEC 61439-1 recommends 1.5-2.5 A/mm² depending on cooling conditions. The cross-sectional area (A) can be calculated using: $A = I / J$ Where I is the design current and J is the current density. A safety factor of 1.25 is typically applied to account for future load growth and temporary overloads. The width of the busbar should generally be at least three times its thickness to avoid hot spots, and any tabs or mounting holes must be considered in the cross-section.

Thermal Considerations

Busbars must not exceed the temperature rise limits specified by IEC 61439. For copper, the typical limit is 70°C above ambient, and for aluminum, 55°C above ambient. Proper ventilation, spacing, and insulation help manage heat dissipation.

Short-Circuit Withstand

Busbars must withstand short-circuit currents both thermally and mechanically. Thermal withstand ensures the busbar does not exceed material limits during a fault, calculated using the adiabatic formula: $A \geq \sqrt{I^2 t / k}$ Where I is the short-circuit current, t is the fault duration, and k is a material constant (143 for copper, 13 for aluminum). Electrodynamic forces between parallel busbars must also be checked to prevent mechanical deformation.

Insulation and Safety

For 10 kV applications, insulated or enclosed busbars are recommended to prevent arcing and ensure safety. Common insulation materials include Nomex(R), Mylar(R), epoxy-glass, and heat-shrink tubing. Bare busbars

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require sufficient spacing to avoid electrical faults .

Busbar Types and Configuration

- o Rigid busbars: Solid copper or aluminum, suitable for high current and stable installations.
- o Flexible busbars: Thin copper layers or braided conductors, used for connections to breakers or moving parts.
- o Flat or laminated busbars: Optimize space and cooling, often used in compact switchgear .

Design Steps Summary

- o Determine the design current and apply a safety factor.
- o Select material (copper or aluminum) based on conductivity, cost, and space.
- o Calculate cross-sectional area considering current density, temperature rise, and mechanical constraints.
- o Verify short-circuit thermal and electrodynamic withstand.
- o Choose busbar type, insulation, and spacing according to 10 kV voltage level and IEC 61439 standards.
- o Ensure mounting and support can handle mechanical forces during faults . By following these guidelines, a 10 kV busbar can be safely and efficiently designed to meet electrical, thermal, and mechanical requirements while complying with international standards.

Note: Prices may vary based on batch size, mechanical rating, and surface finishing. PUTAI Electric -

Busbar sizing calculator for copper and aluminum per IEC 61439. Current rating,

Master 10kV high-voltage equipment selection with detailed parameter calculations. Learn

Typical Busbar Sizes If this program recommends sizes that do not fit into the ranges below, change either the number of conductors

Busbars are not only easy to install (certainly compared to cabling), they also play a major role in the design and safe

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Conductors Conductor

Figure 1: Busbar Standard Scope of IEC 61439 The IEC 61439 standard applies to busbar

Explore the structure, materials (copper/aluminum), packaging types (solid, laminated,

Conductor material selection is critical in meeting electrical performance and mechanical rigidity requirements. Common materials

The introduction of the IEC 61439 switchgear and control standards has had significant implications for the design and

Selecting the busbar of right size and ampacity can save your budget, enhancing the system efficiency. In today's

(2) Selection of main busbars for low-voltage transformers (excluding special customer requirements) When selecting busbars,

Choose the right MV switchgear copper busbar the first time--avoid overheating, fault

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