**ZITHA TECH SPECIALTY CABLES (Pty) Ltd**

# Requirements for 10kV Indoor Rigid Busbars



## Overview

Electrical current-carrying requirements determine the minimum width and thickness of the conductors.

## Key Takeaways

10kV indoor rigid busbars must meet IEC 61439 standards for current rating, short-circuit withstand, insulation, mechanical support, and thermal performance, with copper or aluminum conductors sized for continuous load and fault conditions.Electrical Requirements



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Current Rating and Cross-Section: Busbars must carry the rated continuous current without exceeding permissible temperature rise. The cross-sectional area is determined by conductor width and thickness, typically using a design basis of approximately 400 circular mils per ampere, adjusted for laminated structures and AC skin effect at higher frequencies (Mersen) . Copper is preferred for higher conductivity, while aluminum requires a larger cross-section for the same current (IEC 61439) . Short-Circuit Withstand: Busbars must withstand short-circuit currents for a specified duration (usually 1–3 seconds) without mechanical or thermal failure. The mechanical design must account for electrodynamic forces generated during faults, including axial and lateral stresses (RITZ) . Voltage and Insulation: For 10kV indoor applications, insulation must provide adequate creepage and clearance distances. Common insulation materials include Nomex®, Mylar®, Kapton®, epoxy-glass, and heat-shrink coatings. Laminated busbars may use adhesive-coated insulation layers to reduce inductance and improve capacitance, enhancing electrical performance (Mersen) .

Mechanical Requirements

Rigidity and Support: Busbars must be mechanically rigid to prevent deformation under thermal expansion and short-circuit forces. Supports typically include insulators, suspension brackets, or modular fastening systems with aluminum profiles, angle brackets, and plastic clamps. Supports should allow axial sliding where multiple fastening points exist to accommodate expansion (RITZ) . Mounting and Connections: Hardware such as studs, holes, and tabs must be designed to avoid hot spots. The width of the conductor should be at least three times its thickness, and cross-sectional area must be increased by 5% for each additional laminated conductor to compensate for heat accumulation (Mersen) . Plating on termination surfaces (tin, nickel, silver, or gold) improves contact conductivity and reduces voltage drop.

Thermal and Environmental Considerations

Temperature Rise: IEC 61439 specifies allowable temperature rise limits, typically 70°C above ambient for copper and 55°C for aluminum. Ambient temperature, enclosure type, and mounting orientation affect heat dissipation and must be considered in sizing (IEC 61439) . Environmental Protection: Indoor busbars should be protected from dust, moisture, and accidental contact. Epoxy coatings or fully insulated busbars provide additional safety and reduce the risk of short circuits (PAYAPRESS) .

Standards Compliance

IEC 61439: Defines requirements for low-voltage switchgear assemblies, including busbar sizing, insulation, temperature rise, and short-circuit withstand . IEC 60287: Provides guidance on current-carrying capacity calculations for conductors . UL 891: Applicable in North America for switchboard busbars .

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Summary

For 10kV indoor rigid busbars, ensure:

• Proper conductor material and cross-section for rated current and fault conditions.

• Adequate insulation and creepage/clearance distances.

• Mechanical rigidity with supports designed for thermal expansion and short-circuit forces.

• Compliance with IEC 61439 and related standards.

• Consideration of plating, laminated insulation, and thermal management to optimize performance and safety. Early involvement of design engineers is recommended to optimize cost, manufacturability, and compliance with electrical and mechanical requirements (Mersen) .

## Article Content

Busbar Design in Switchgear: Key Principles & Best

Busbars should be cut and bent carefully to avoid cracks, sharp edges, or stress points.

Design Guide for bus bars

Electrical current-carrying requirements determine the minimum width and thickness of the conductors. Mechanical considerations

Current Rating, Temperature Rise, IEC 61439

Copper busbars have 60% higher conductivity than aluminium but cost more and weigh more (8,900 vs 2,700 kg/m3).

BUS BARS SIS

To ensure a continuous, potential-free bus bar system, an insulated connection sleeve is fitted between the sections, covering the

IEC Standard for Busbar Sizing: IEC 61439 Requirements

These standards specify the parameters that should be considered when sizing busbars, including current rating, short

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

This standard defines the design verification, test requirements, and thermal performance of the assemblies. The IEC

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Bus Spacings in Metal-Enclosed Switchgear

Dielectric tests, power frequency withstand for all voltages and impulse withstand for medium voltage, are specified in the standards.

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How does temperature rise affect the mechanical integrity of aluminium busbars, and what are the mitigation strategies?

Busbars: Electrical Types, Sizing & Design Guide

Learn what busbars are, how they distribute current, and how engineers check sizing, ampacity, supports, fault

Busbar Standards: Design, Installation & IEC 61439

This guide covers busbar design standards, installation engineering practices, and IEC 61439 requirements, while

Bus Spacings in Metal-Enclosed Switchgear

When considering bus spacings, two dimensions are important. The first is clearance, or the distance through air between

Busbars and Connectors in HV and EHV installations

In indoor medium-voltage (MV) and low-voltage (LV) installations—particularly where high currents and

Technical Application Papers No.11 Guidelines to the construction

The basic Standard establishes the requirements for the construction, safety and maintenance of the assemblies by identifying

Design and installation of low voltage busbar trunking systems

Feeder Trunking Run Feeder trunking runs are used for the interconnection between switchboards or switchboard

Non-segregated phase bus duct design guide

Non-segregated phase bus is an assembly of bus conductors with associated connections, joints and insulating supports confined

Guide To Busbar Systems And IEC 61439 Standards

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

ALUMINIUM PIPE BUS

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The material shall be clean smooth and free from any harmful effect. Standard Aluminium pipes of minimum size 4", 3", 2.5" and 1.5"

IEC 61439 Busbar Standard: A Guide to Low-Voltage

This standard covers busbars used for low-voltage assemblies, power distribution,

Rigid busbar — CupralBridge

Rigid busbar (OZh-CuprAl) is designed for electrical connections between high-voltage apparatuses of 3 phase AC, 50 Hz open

How to Design Busbar Systems for Substations

Learn how to design efficient substation busbar systems with calculations, examples, and best practices.

1427-2020

This guide, covering three-phase ac systems from 1 kV to 800 kV, provides recommended electrical operating, safety clearances,

Substation & Switchyard Design Considerations: Size, Load, Cost

The switchyard generally consists of disconnectors, earthing, circuit breakers, busbars, and auto-transformers

Substation Primary Design Standard

Fire zone requirements – Multiple busbar switchboards may require fire ratings between bus sections, for the switchgear and/or the

SPECIFICATION FOR INDOOR MEDIUM/ HIGH VOLTAGE (1KV

This specification covers Transnet Projects requirements for the supply, delivery and installation of indoor, high voltage, 3 phase, 50

Catalogue SIMABUS-EPP-2829-8-16 rev2-HD

1 -EXPERIENCE THE FUTURE WITH SIMABUS CONNECTORS TE Connectivity''s (TE) Simel first generation connectors have

Installation of hard busbars, wall bushings and post insulators

11.2 Installation of hard busbars, wall bushings and pillar insulators 1. Production and installation of busbars In the

FULLY INSULATED BUS BAR SYSTEM

FULLY INSULATED BUS BAR SYSTEM FOR INDOOR AND OUTDOOR APPLICATIONS UP TO 40.5 KV / 8000 A

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BUSBAR

CABLE TO BUSBAR Weld ProEV 4 mm2 - 120 mm2 to copper busbar

Policy Statement on Busbar Configuration for 110 kV, 220 kV

New substations are defined as radial or meshed 110 kV, 220 kV or 400 kV substations that are not already constructed and/or

Bus Bars and Bus Ducts Design Requirements ANSI C37.23

This article is for manufacturing, testing of non-segregated Bus Bars and Bus Ducts rated 600 V to 35 kV as per international

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Busbar Size Calculation Formula | Aluminium and Copper Examples

Total Derating Factor Busbar Size Calculation Formula Electromagnetic Forces Generated by Busbar when Short

High Voltage Rigid Bus Connectors

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Overview Our SIMABUS High Voltage Rigid Bus Connectors is designed for rigid bus connections in AC & DC applications up to 500

AC substation design guidelines: Best practice, dos and don''ts

Therefore earthing switches are preferable in substations above 145 kV. Portable earthing devices are only used for

IEC Standard For Busbar Clearance : Electrical Engineering Hub

IEC Standard for Busbar Clearance explained with IEC 61439 requirements, minimum clearance distances, insulation

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