

# How to segment the busbar of a low-voltage switchgear

## Article Overview

Segmented busbar operation in low-voltage switchgear allows independent sections to be isolated for maintenance or fault management while maintaining IEC 61439 compliance and thermal safety.

## Concept of Segmented Busbar Operation

Segmented busbars divide the main busbar into independent sections or compartments, enabling selective disconnection of parts of the switchgear without interrupting the entire system. This approach enhances operational flexibility, safety, and maintenance efficiency by allowing one segment to be serviced while others remain energized. Segmentation is particularly important in modular low-voltage switchgear assemblies, where multiple functional units are connected to a common busbar.

## IEC 61439 Compliance and Internal Separation

IEC 61439 defines Forms of Internal Separation that directly impact busbar segmentation:

- o Form 1: No separation between busbars and functional units.
- o Form 2: Separation of functional units only.
- o Form 3: Separation of busbars and functional units.
- o Form 4b: Full separation of busbars, functional units, and terminals, including interconnections. Higher forms, such as Form 4b, are recommended for segmented busbar operation because they provide arc fault containment, personnel protection, and clear isolation between segments, which is critical for safe maintenance and fault management.

## Thermal and Electrical Considerations

Busbars do not operate at maximum load continuously. IEC 61439 specifies thermal limits to prevent overheating, with a maximum permissible temperature of 140°C under rated load and a diversity factor applied to account for non-simultaneous loading. Segmented busbars must be designed to handle short-circuit currents, rated operational currents, and temperature rise independently for each segment. Verification can be performed via testing, calculation, or comparison with reference designs.

## Operational Advantages

- o Maintenance without full shutdown: Individual segments can be isolated for inspection or replacement.
- o Fault containment: A fault in one segment does not propagate to the entire busbar.
- o Load management: Segments can be sized according to expected load and diversity factors, optimizing

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thermal performance and reducing energy losses .

o Modular expansion: Additional segments can be added without redesigning the entire busbar system .

## Practical Implementation

Segmented busbars are typically installed in compartmentalized switchgear assemblies, with finger-safe covers, busbar supports, and modular connectors to ensure safe operation and easy assembly . Each segment is electrically and mechanically isolated, allowing quick disconnection and reconnection while maintaining compliance with IEC 61439 standards. In summary, segmented busbar operation in low-voltage switchgear provides a balance of safety, flexibility, and thermal management, ensuring that each segment can operate independently while meeting IEC 61439 requirements for temperature rise, short-circuit withstand, and internal separation .

Learn how low voltage switchgear design balances busbar current rating, cabinet space, heat management, and

Learn LVSG design, construction, and calculations. Covers enclosures, busbars, IP ratings, and forms of separation. Electrical

Overview A common strategy in mature switchgear platforms is not to use completely different busbar sizes for every rating, but to

Main Busbars The MNS main busbar system is arranged in the rear of the switchgear. This assures a maximum distance between

Figure 1: Solid copper busbars in the low-voltage range in an indoor switchgear cabinet. Due to the relatively low voltages, the three

Learn the fundamentals of medium voltage switchgear. Topics include &quot;what is switchgear?, types of

Choosing the right busbar material is a key step in switchgear design. Material choice affects electrical performance,

There are many different types of enclosure designs for medium voltage switchgear use. However, the most

I worked twelve years at Schneider Electric in the position of technical support for low- and medium-voltage projects

Low-voltage switchgear fundamentals What is switchgear? Electrical switchgear refers to a centralized

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collection of circuit breakers,

What Are Electric Busbars? An electric busbar (also written as bus bar) is a metallic bar, strip, tube, or rod

I'm highly specialized in the design of LV/MV switchgear and low-voltage, high-power busbar trunking (<6300A) in

The international standard for low voltage switchboard arrangements, IEC 61439 "Low-voltage switchgear and control

In each test, the incoming circuit and the busbars are loaded to their rated current and as many outgoing circuits in a group are

A continuous horizontal bus, rated 1,600 to 5,000 amps, distributes incoming power to all switchgear sections. The horizontal bus is

Proper planning of safety distances in low-voltage busbar design and installation is critical for ensuring electrical performance,

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