Online Temperature Measurement of Tubular Busbars



Overview

Busbar Calculator — Current Rating, Temperature Rise, The busbar sizing calculator determines the required busbar dimensions based on the continuous curren.

Key Takeaways

Busbar temperature can be accurately monitored using surface-mounted sensors, embedded sensors, or fiber optic systems to ensure safe operation and compliance with IEC 61439 standards.

Direct Temperature Measurement

Direct measurement involves attaching sensors to the busbar itself. Common methods include: Surface-mounted sensors: Thermocouples or PT100 sensors can be fixed to the busbar surface to measure temperature at specific points. Care must be taken to account for cooling effects from air drafts or surrounding components, which can cause variations in readings across the busbar surface.

Embedded sensors: For more precise internal temperature monitoring, a small hole can be drilled into the busbar, and a bolt-in sensor such as a Neuron PT100 can be installed. This allows continuous measurement of the internal conductor temperature, providing more accurate data than surface readings alone.



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Indirect Temperature Monitoring

Indirect methods estimate the internal conductor temperature based on surface measurements and thermal modeling: Radial and axial temperature calculations: Using models like RDTC (radial direction temperature calculation) and ADTC (axial direction temperature calculation), the internal temperature of fully insulated busbars can be inferred from surface readings. Iterative correction methods account for contact resistance at joints, achieving steady-state errors typically within 1–5 K. Joint hotspot monitoring: Prefabricated or taped busbar joints can be monitored indirectly to detect abnormal contact states, which may lead to localized overheating.

Continuous Monitoring Systems

For industrial or switchgear applications, continuous monitoring ensures early detection of temperature rise: Fiber optic Linear Heat Detection (LHD): A fiber optic sensor cable can be installed along the busbar or within switchgear panels. The system measures the complete temperature profile in seconds, providing precise localization of hotspots and configurable alarms for static, rate-of-rise, or maximum temperature thresholds. Integration with SCADA: Temperature data from sensors can be fed into SCADA systems for real-time monitoring, logging, and automated alerts, enabling proactive maintenance and reducing the risk of fire or equipment damage.

Standards and TestingIEC 61439 recommends temperature rise testing for busbars to ensure that continuous current does not exceed material limits. Bare copper busbars typically allow a 70 K rise above 35°C ambient, while bolted connections may tolerate up to 105 K. Temperature rise tests validate both the busbar design and the effectiveness of monitoring systems, ensuring safe operation under rated current and fault conditions.

Practical Considerations

Sensor placement should be consistent to allow repeatable measurements. Environmental factors such as airflow, enclosure design, and proximity to other heat sources must be considered. Both direct and indirect methods can be combined for enhanced accuracy, especially in high-current or fully insulated busbar systems.

By implementing these measurement techniques, engineers can ensure safe operation, detect hotspots early, and comply with international standards for tubular busbars in industrial and power distribution applications.

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Article Content

Busbar Calculator — Current Rating, Temperature Rise,

The busbar sizing calculator determines the required busbar dimensions based on the continuous current rating, short circuit withstand, and

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Busbar Temperature Monitoring for High Voltage Switchgear: 8

Expert guide to switchgear busbar temperature monitoring: Compare wireless temperature sensors, fiber optic systems, infrared for MV/HV switchgear. Learn why passive wireless

IoT-Based Condition Monitoring of Busbar | Springer Nature Link

The assets for an electrical utility are mainly Transformer, circuit breakers, surge arresters, Insulators, Current transformers, busbars, etc. Busbars are the critical part of the system

Conductor temperature monitoring for the fully insulated busbar ...

Establish axial function Hotspot temperature Tj FIGURE 2 The algorithm for hotspot temperature monitoring of fully insulated busbar joint being applied to busbar. The most common indirect real-time

Enhancing busbar safety: a smart thermal imaging pipeline for real

To address these issues, we developed a smart, non-destructive system utilising thermal imaging for continuous monitoring of busbars. Thermal imaging offers non-invasive detection of

Conductor temperature monitoring for the fully insulated busbar ...

Taking the uncertainty of contact resistance into account, this paper presents an indirect approach to monitor the conductor temperature for the fully insulated busbar prefabricated joint using

Thermal Analysis of Busbars from a High Current Power Supply

Therefore, in the previous works, the authors focused on the current harmonic influences on busbar behaviour, temperature measuring methods (on-line) of busbars, protection and analysis

Switchgear and Busbar Temperature Monitoring

Switchgear and busbars can be constantly and comprehensively monitored for temperature rises without a complicated setup. Our solution provides reliable and intelligent alarming

Understanding the Busbar Temperature Monitoring System

What is the Busbar Temperature Monitoring System? A busbar temperature monitoring system is designed to continuously measure and monitor the temperature of busbars within a bus duct.

MNS® Temperature Monitoring System Monitoring critical

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ACB and busbar temperature monitoring MNS busbars are maintenance-free when assembled in ABB factories with full quality control, while air circuit breaker incoming termination and shipping splits are

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