

How to measure the online temperature of tubular busbars



Overview

Current Rating, Temperature Rise, IEC 61439 Busbar sizing calculator for copper and aluminum per IEC 61439. Current rating, temperature rise, short-circuit.

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 .

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 Testing

- IEC 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.

Article Content

Busbar Monitoring System | Fiber Optic Busbar Temperature

Busbar monitoring is the continuous, real-time measurement of temperature, current, and insulation condition at critical points along

Busbar & Dense Busway Temperature Monitoring

DTS distributed fiber optic and passive wireless temperature sensing provides lifecycle online monitoring for busbars in data centers,

A simple method to estimate maximum temperature for

Based on the heat transfer theory and Thermal-Electric module, a simple method for quickly predicting the maximum

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