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Temperature Sensing Optical Cable Testing



Overview

Distributed Temperature Sensing (DTS) | AP SensingDistributed Temperature Sensing (DTS) systems provide temperature information for accurate thermal Fiber.

Key Takeaways

Testing a temperature-sensing optical cable involves verifying signal integrity, calibration, and response to known temperature changes using appropriate photodetectors or DTS systems.1. Understand the Sensor Type

Temperature-sensing optical cables can use fiber Bragg gratings (FBGs), interferometric sensors, or non-interferometric semiconductor-based fibers. Each type responds differently to temperature changes: FBGs shift reflected wavelengths, interferometric sensors modulate phase, and semiconductor fibers (e.g., GaAs) change optical absorption or transmission with temperature . Knowing the sensor type is essential for selecting the correct testing method.

2. Visual and Physical Inspection

Before electrical or optical testing, inspect the cable for physical damage, bends, or coating degradation. Ensure the fiber is properly housed in protective sheathing (metal-free, armored, or tube-in-tube) to prevent breakage or signal loss . Check connectors and terminations for cleanliness and proper alignment.

3. Connect to a Measurement System

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Use a Distributed Temperature Sensing (DTS) system or a compatible photodetector setup. DTS systems allow continuous monitoring along the entire fiber length, while point sensors like FBGs require an optical interrogator . Ensure the system is calibrated for the fiber type and temperature range.

4. Calibration and Reference Testing
• Calibrate the system using a known temperature reference, such as a temperature-controlled bath or calibrated thermocouples.

• Apply stepwise temperature changes along the fiber and record the sensor response. The measured temperature should match the reference within the sensor's specified accuracy (typically ±1°C for non-interferometric fibers), .

• For high-temperature fibers (e.g., sapphire or polyimide-coated), ensure the calibration covers the expected operational range .
5. Signal Verification
• Check for signal attenuation or noise along the fiber. Excessive loss may indicate microbends, connector issues, or fiber damage .

• For FBGs, verify that the wavelength shift corresponds linearly to temperature changes.

• For interferometric sensors, confirm that phase modulation matches applied temperature variations.
6. Environmental and Stress Testing
• Test the cable under mechanical stress, vibration, or electromagnetic interference if it will be deployed in harsh environments. Fiber optic sensors are immune to EMI, but physical stress can affect readings .

• For distributed sensing, simulate hotspots or temperature gradients to ensure the system detects localized changes accurately .
7. Documentation and Recalibration
• Record all test results, including baseline readings, calibration curves, and response times.

• Recalibrate the system periodically or when switching to a different fiber or sensor type to maintain measurement reliability . By following these steps, you can ensure that a temperature-sensing optical cable is functioning correctly, providing accurate and reliable temperature measurements across its intended range and environment.

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