Installation of underground temperature measurement optical cable

Article Overview

Distributed fiber-optic temperature sensing (DTS) cables can be installed underground to provide continuous, real-time monitoring of cable temperature, hotspots, and thermal performance.

Cable Selection

For underground temperature monitoring, single-mode optical fibers are typically preferred due to their low attenuation and long-distance performance, compliant with ITU-T G.652/654/655 standards, with bend-insensitive fibers (G.657) recommended for tight routing ( ). Loose-tube constructions are common for DTS applications, allowing fibers to float freely within the tube, minimizing strain and compression, and can be gel-filled or dry-blocked for water protection. For harsh environments, Fiber-In-Metal-Tube (FIMT) cables provide high tensile strength and crush resistance ( ).

Installation Methods

o Direct Burial: Cables can be buried directly in trenches with protective conduits or sand bedding to prevent mechanical damage. Depth and protective layers should comply with local regulations and environmental conditions ( ).

o Conduit Installation: Using PVC or HDPE conduits provides additional protection against moisture, soil movement, and mechanical stress.

o Embedded in Cable Systems: DTS fibers can be integrated into existing power cable sheaths or alongside the cable in a dedicated monitoring cable, ensuring accurate thermal readings ( ).

Monitoring Considerations

o Temperature Measurement: DTS systems measure temperature along the fiber using Raman or Brillouin scattering, providing near-continuous monitoring of the cable length ( ).

o Hotspot Detection: Proper placement ensures detection of potential hotspots, cold spots, and thermal bottlenecks, which are critical for ampacity management and cable lifetime prediction ( ).

o Integration with Control Systems: DTS and other fiber-optic sensing systems (DAS, DTSS) can be integrated into centralized monitoring platforms for real-time alerts and historical data analysis ( ).

Environmental and Mechanical Protection

o Water Blocking: Gel-filled or super-absorbent polymer powders prevent water ingress without affecting optical performance ( ).

o Mechanical Protection: Additional layers such as aramid fibers, stainless steel wires, or plastic sheaths protect against strain, crushing, and chemical exposure ( ).

o Thermal and Strain Considerations: Loose-tube fibers minimize strain effects, but for strain or deformation monitoring, tight-buffered or bonded fibers may be required ( ).

Best Practices

o Consult with fiber sensing suppliers to select the appropriate cable type and installation method for the specific underground environment ( ).
o Ensure proper trenching, bedding, and backfilling to avoid mechanical stress and maintain fiber integrity.
o Plan for access points and splicing locations to facilitate maintenance and calibration.
o Use DTS in combination with thermal models to estimate conductor temperature accurately, as direct measurement of the conductor is not feasible ( ). By following these guidelines, underground optical cables can provide reliable, continuous temperature monitoring, enabling early detection of anomalies, optimized load management, and extended cable lifespan ( ).

Dive into the principles of Distributed Temperature Sensing (DTS) with Silixa. Explore optical fiber technologies for diverse

This report summarizes distributed fiber optic-based temperature measurement technologies and how this type of technology can be

Distributed Temperature Sensing (DTS) systems provide temperature information for accurate thermal monitoring, fire detection, and

Cable Installation Considerations for Structure Monitoring Introduction Distributed fiber optic sensing (DFOS) techniques such as

The proposed cable temperature measurement system is based on placing NTC thermistors along the cable, with

Our underground cable monitoring solution provides enhanced reliability, cost efficiency, and improved safety through

The Luna EN.SURE power cable DTS system is an optical fiber-based temperature measurement system designed to monitor

Distributed fiber optic sensors (DFOSs) possess the capability to measure strain and temperature variations over long

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Cable segments, joints, and terminations are particularly susceptible because they are likely to undergo

The monitoring system demonstrated herein uses Fiber Bragg Grating (FBG) sensors to measure multiple

This study proposed a sensor module that can monitor the temperature of the power cable joint using a fiber optic

Measure temperature with fiber optic sensors for high-resolution distributed and multipoint monitoring in

Fiber optic sensor cables are the key enabler for real-time monitoring of temperature, strain, and acoustic signals across diverse and

High-resolution temperature sensing with Raman-OFDR using fiber-optical communication cables shows great

Abstract and Figures Quasi-continuous temperature profiles can be measured in boreholes deploying fibre-optic

Temperature monitoring using fiber optic sensors to get a distributed temperature profile along an underground cable

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