

Dimensions of downhole temperature measurement optical cable

Article Overview

Downhole temperature measurement optical cables typically use a tube-in-tube design with fiber-in-metal tubes (FIMT), customizable fiber counts, and diameters optimized for high-pressure, high-temperature well environments.

Cable Construction and Size Considerations

Downhole optical cables are designed to withstand extreme conditions, including high temperatures, pressures, and mechanical stresses. The core of the cable is a fiber-in-metal tube (FIMT), which houses single-mode or multimode fibers. The FIMT is hermetically sealed, often in stainless steel or INCONEL(R), and filled with gels to protect against microbending and chemical ingress. The FIMT is centralized within an outer tube using an extruded polymer layer called a belt, which provides mechanical buffering and ensures the fibers remain strain-free during deployment. The outer tube acts as the primary pressure barrier, protecting the cable from high-pressure fluids, mechanical shock, and corrosive environments. Additional encapsulation or armor layers can be added for further protection during deployment, especially in high-velocity or abrasive conditions.

Typical Dimensions

- o Fiber-in-metal tube (FIMT) diameter: Usually ranges from 1.0 mm to 2.0 mm, depending on the number of fibers and type of metal used.
- o Outer tube diameter: Commonly 4 mm to 6 mm, but can be customized for specific wellbore diameters and deployment requirements.
- o Fiber count: Varies from 1 to 12 or more fibers per FIMT, allowing multiple sensing modalities (temperature, strain, acoustic) in a single cable.
- o Cable flexibility: Smaller diameters improve flexibility for coiled tubing or conduit deployment, while larger diameters enhance mechanical robustness.

Environmental and Operational Considerations

Downhole cables must be rated for temperature ranges from -200°C to 700°C and pressures up to 50,000 psi, depending on the application. The choice of fiber coatings (e.g., polyimide, silicone, carbon) and outer encapsulation materials directly affects the cable's survivability and size. Customization allows optimization of diameter, fiber count, and protective layers to balance robustness, flexibility, and sensing performance.

Summary



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For downhole temperature measurement applications:

- o Use a tube-in-tube design with FIMT for fiber protection.
 - o Outer tube diameter typically 4-6 mm; FIMT diameter 1-2 mm.
 - o Fiber count is customizable, often 1-12 fibers.
 - o Include filling gels, belts, and optional armor for mechanical and chemical protection.
 - o Ensure materials and coatings are suitable for high temperature, high pressure, and corrosive environments.
- This configuration ensures reliable, long-term operation of distributed temperature sensing systems in harsh downhole conditions .

Our piezoresistive downhole gauges provide the absolute best reliability and longevity for measuring downhole

One cable with two DAS fibers, two DTS fibers, and one fiber for a downhole fiber optic pressure/temperature gauge

In this study, fiber optic Bragg grating (FBG) measurement technology is utilized applied in an attempt to replace more

Abstract Monitoring the in-situ temperature is key for the characterization of a seasonal geothermal energy storage.

Downhole Cables TEF (Fiber Optic Cables) TEF - LOW TEMPERATURE < 150°C A typical TEF cable is a tube in tube design. The

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The subsurface environment of oil and gas wells presents extreme

Abstract. Distributed Temperature Sensing (DTS) system using optical fiber has been deployed for downhole

Abstract: Raman spectra distributed temperature sensing (DTS) by fiber-optic cables has recently shown considerable

Unfortunately, the downhole environment is not kind to optics: Extremely high temperatures and pressures along with vibration and



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Wireline cables for downhole logging applications, delivering reliable power and data in high-pressure, high-temperature wells.

The GORE®; High Density Sensor Cable (HDSC) is based on a thin, advanced high temperature polymeric insulation material and

DataSphere®; Opsis®; permanent downhole gauges provide pressure and temperature measurements and real-time downhole data

Pressure and temperature are simultaneously output by the accurate demodulation of the optical signal returned from the sensor.

The VIAVI Distributed Temperature Sensing (DTS) solution is based on Raman scattering technology. Measure the temperature

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