

Article Overview

Fiber optic cables for well temperature measurement are designed for harsh downhole conditions, offering distributed temperature sensing (DTS) with high accuracy, long-range monitoring, and robust mechanical protection.

Cable Construction and Design

Permanent downhole fiber optic cables use a tube-in-tube design, where optical fibers are housed in a hermetically sealed stainless steel or INCONEL(R) tube (Fiber in Metal Tube, FIMT) to protect against chemical ingress, high pressure, and elevated temperatures. The FIMT may contain a mix of single-mode and multi-mode fibers to support both temperature and acoustic sensing. Filling gels inside the tube provide additional protection against microbending and chemical effects. The FIMT is supported by an extruded polymer layer (belt) and an outer tube that acts as the primary mechanical shield, with optional armor or encapsulation for extra protection during deployment.

Fiber Types and Sensing

- o Distributed Temperature Sensing (DTS) uses multi-mode fibers to generate a continuous temperature profile along the cable length.
- o Distributed Acoustic Sensing (DAS) uses single-mode fibers for vibration and acoustic monitoring, which can complement temperature measurements.
- o DTS systems, such as Optromix DTS 500/1000 Series or Yokogawa DTSX, can measure temperatures over distances ranging from 16 km to 100 km, with high accuracy (up to 0.01 °C) and real-time monitoring.

Operational Specifications

- o Temperature Range: Designed to withstand elevated downhole temperatures, often exceeding 150°C, depending on the cable materials and deployment conditions.
- o Pressure Resistance: Outer tube and encapsulation provide protection against high-pressure environments typical in wells.
- o Chemical Resistance: Hermetically sealed fibers and protective gels prevent degradation from corrosive fluids.
- o Mechanical Protection: Controlled prestressing during manufacturing ensures fibers remain strain-free, minimizing optical degradation or breakage during deployment.

Measurement Principles



Guatemalan Measurement Specifications

Well Optical

Temperature Cable

DTS systems operate using the Raman scatter principle, where a laser pulse is sent along the fiber and the backscattered light is analyzed. The ratio of Stokes to anti-Stokes signals determines the temperature at each point along the fiber, enabling continuous distributed temperature measurement over long distances .

Customization and Deployment

Cables can be customized for fiber type, quantity, armor, encapsulation, and filler materials to match specific well conditions. Deployment requires careful planning to ensure strain-free installation and reliable long-term operation .

Summary

For Guatemalan wells, fiber optic cables for temperature measurement should feature:

- o Tube-in-tube construction with FIMT
 - o Multi-mode fibers for DTS, optionally combined with single-mode for DAS
 - o High temperature, pressure, and chemical resistance
 - o Long-range monitoring capability (up to 100 km)
 - o Real-time, continuous temperature profiling with high accuracy
 - o Mechanical protection and prestressing to prevent fiber damage
- These specifications ensure robust, accurate, and reliable temperature monitoring in challenging downhole environments, supporting well productivity and safety.

Imagine being able to continuously, accurately, and in real-time detect small acoustic, temperature, and/ or strain changes

The OPTITEMP TRA-W30 is a clamp-on cable sensor (RTD) for pipe diameters up to DN300 / 12" .
The surface temperature sensor

The High-temperature Resistant Well Logging Optical Cable Suitable for oil wells, gas wells, coal mines or under high temperature

The optical fibers can be used to sense temperature and listen to well bore activities along the entire length

The Halliburton OdaSea Subsea Fiber Optic Solution provides topside fiber optic sensing of subsea wells using distributed acoustic



Guatemalan Measurement Specifications

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Permanent downhole fiber-optic cables are critical infrastructure in wellbore monitoring systems, ensuring reliable transmission of

For this purpose, a portable pressure and temperature (P/T) optic fiber wire-line instrument prototype was developed,

Get a complete guide to fiber optic & related products standards--from basics to advanced, covering all key details for

Summary To allow sustainable development and operation of deep geothermal wells, it is crucial to have a good understanding of

Optiq solutions deliver distributed acoustic, temperature, temperature gradient, and strain and temperature sensing for applications

Optical fibers that are incorporated within these cables are used for telemetry to the tool, but can also be monitored for distributed

Suitable for oil wells, gas wells, coal mines or under high temperature conditions. The cables marked with Dry; They are a series of

The experience from the well Breitbrunn 21 shows that the fibre optic temperature sensing system is an efficient

In this study, we installed two fiber optic cables with different designs into a new well, a soft-flat cable and a stainless

Temperature monitoring Robust fiber optic temperature sensor packaged for the most demanding environment. Permanent exposure

A carbon-coated and bellow-packaged optical fiber sensor for high pressure and high temperature monitoring in

Web: <https://www.kremgroup.co.za>

