

Principle of Swedish Well Logging Optical Cables



Overview

In the 1970s, a new approach to wireline logging was introduced in the form of logging while drilling (LWD). This technique provides similar well information to conventional wireline logging but instead of sensors being lowered into the well at the end of wireline cable, the sensors are integrated into the drill string and the measurements are made in real-time, whilst the well is being drilled.

Key Takeaways

Swedish well logging optical cables operate by transmitting modulated light signals through fiber optics to measure subsurface formation properties, converting these signals into electrical data at the surface without using optical slip rings. Core Principle

Swedish well logging optical cables are designed to replace or supplement traditional electrical logging cables with fiber optic technology to achieve higher data transmission rates and improved signal fidelity. The system typically consists of a fiber optic cable integrated into a well logging cable, a downhole measurement tool (sonde), and a surface winch unit for deployment and data acquisition. The fiber optic cable carries modulated light signals representing measurements such as temperature, strain, or acoustic responses from the subsurface formations. At the downhole tool, sensors convert physical properties of the formation into optical signals. These signals travel along the fiber to the surface, where an electro-optical transducer mounted on the winch drum converts the light signals into electrical signals for processing.

Signal Transmission Without Optical Slip Rings

A key innovation in Swedish optical well logging is the elimination of optical slip rings, which are traditionally used to transfer light signals from a rotating drum to stationary equipment. Instead, the system uses a transducer mounted directly on the rotating winch drum to convert optical signals into electrical signals, which are then transmitted to stationary receivers. This approach avoids the alignment challenges and precision requirements of optical slip rings, making the system more robust for field operations .

Cable Design Considerations

The optical fibers are often armored or enclosed in protective sheaths to withstand the mechanical stresses of repeated spooling, bending, and axial tension during lowering and raising of the logging tool. The cable may also include electrical conductors for power delivery or hybrid sensing applications . Proper design ensures that the cable maintains a round cross-section and resists deformation under high tension, which is critical for reliable signal transmission.

Applications and Advantages

Swedish well logging optical cables are used in oil, gas, geothermal, and environmental wells for high-resolution measurements. They enable:

- Distributed temperature and strain sensing using techniques like Optical Backscatter Reflectometry (OBR) or Distributed Acoustic Sensing (DAS) to monitor downhole conditions in real-time .
- High data bandwidth for complex logging tools, allowing simultaneous acquisition of multiple parameters.
- Long-term monitoring of wells, including abandoned wells, without degradation of signal quality . By leveraging fiber optics, these systems provide enhanced sensitivity, real-time monitoring, and reduced interference compared to conventional electrical logging cables.

Summary

The principle of Swedish well logging optical cables is based on fiber optic signal transmission from downhole sensors to surface processing units, with innovative drum-mounted transducers eliminating the need for optical slip rings. This design allows for high-speed, high-fidelity data acquisition in challenging well environments, supporting both real-time monitoring and long-term subsurface studies .

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Well logging

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WO/2021/034184 OPTICAL CABLE, OPTICAL CABLE MONITORING

The optical cable (10, 10a) configured as described above is installed along the depth direction of a well (100) that is a measurement

GB2333610A

Direct substitution of electrical conductors with optical fibres to provide a logging cable having optical fibres can result in the cable

Permanent fiber-optic cable

To further enhance reliability, the cable is manufactured with controlled overstressing. Designed to prestress the cable assembly

Well Logging: Principles, Applications and Uncertainties

The wireline logging operation showing logging truck, logging cable strung into the rig, then lowered into the purposes depending on

Vertical seismic optical profiling on wireline logging cable

A single shot generated equivalent data with an experimental optical wireline logging cable and an adequate optical interrogator at

Production logging via coiled tubing fiber optic ...

In the development of a shale gas horizontal well, gas production profile logging can provide the critical fluid-carrying

Oil Well Load Bearable Detecting Cable-Well Logging Cable

Oil Well Load Bearable Detecting Cable-Well Logging Cable Conductor: composed of copper conductors, insulating plastic and steel

A High Data Rate Fiber Optic Well Logging Cable

This development has led to a new logging cable with superior mechanical properties, containing eight electrical wires and three

Permanent fiber-optic cable

These monitoring systems help improve well productivity by identifying trends throughout the producing life of the well, and they rely

Evolution Of Wireline Well-Logging Techniueq (The Eye Of Oil

The transmission of downhole data through wireline cable has opened a new era in well-logging offering the scope of recording vast

The High-temperature Resistant Well Logging Optical Cable

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

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