Schlumberger

ThruBit Dipole

Through-the-bit acoustic service

APPLICATIONS

- Petrophysics
  - Porosity estimation
  - Lithology and clay identification
  - Gas identification
  - Fracture evaluation
  - Cased hole evaluation
- Geomechanics
  - Anisotropy and stress characterization
  - Hydraulic fracturing optimization
  - Guidance for selective perforating and sand control
  - Well placement and borehole stability evaluation
- Geophysics
  - Anisotropy characterization for seismic workflow
  - Velocity calibration and time-depth conversion
  - Improved 3D seismic analysis and seismic tie-ins
  - Synthetic seismograms

ThruBit Dipole* through-the-bit acoustic service provides a detailed acoustic representation of the formations surrounding the borehole for horizontal or challenging well profiles. The latest acoustic technology is used to acquire monopole compressional (P) and shear (S), cross-dipole, and Stoneley wave measurements. The slim 2 1/8-in diameter and memory logging mode provide critical flexibility for acquiring critical data in both open and cased holes.

The receiver section of ThruBit Dipole service has an array of 12 receiver stations spaced 4 in [10.16 cm] apart. The receiver array is 70.2 in [1.78 m] from the monopole transmitter and 78 in [1.98 m] from the dipole transmitters. Each receiver station consists of four azimuthal wideband piezoelectric hydrophones aligned with the dipole transmitters. Summing the signals recorded by all four hydrophones provides the monopole waveform, whereas finding the difference between a pair of opposing hydrophones cancels the monopole signal and provides the dipole waveform. Four sets of 12 waveforms can be acquired from the four basic operating modes fired in sequence.

The transmitter section houses two sets of transmitters and a mechanical isolation assembly to prevent direct flexural wave transmission through the tool body of ThruBit Dipole service. A piezoelectric monopole transmitter is fired at standard frequency or a specific low-frequency pulse for Stoneley wave acquisition. Two collocated, perpendicular, piezoceramic bender element dipole transmitters fire a wideband frequency spectrum to capture dipole data at a high signal-to-noise ratio.

A 3D anisotropy algorithm is used to transform compressional, fast and slow shear, and Stoneley slowness measurements with respect to the borehole axes to referenced anisotropic moduli. The formation can then be classified as isotropic or anisotropic, along with determining the type and cause of the anisotropy—intrinsic or stress induced from the drilling process.

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Measurement Specifications	
	ThruBit Dipole Service
Output	Monopole compressional, dipole shear, full waveforms, Stoneley fracture evaluation, anisotropy characterization
Logging speed	1,800 ft/h [549 m/h]
Range of measurement	Compressional slowness: <170 us/ft [<558 us/m]
	Dipole shear slowness: <200 us/ft [<656 us/m]
Vertical resolution	<44-in [<1.12-m] processing resolution for 6-in [15.24-cm] sampling rate
Accuracy	Δt for <8.75-in hole size: ±2 us/ft or ±2% (whichever is greater)
Mud type or weight limitations	Aerated and foam muds are usually outside the operating range of acoustic tools
Combinability	Fully combinable with all ThruBit services tools
	Open and cased holes
	Conveyance: standard wireline, wireline through pipe, memory mode, memory pumpdown mode, tractor, coiled tubing, and slickline

Mechanical Specifications	
	ThruBit Dipole Service
Temperature rating	300 degF [150 degC]
Pressure rating	17,500 psi [120 MPa]
Borehole size—min.	Minimum drift for conveyance through drillpipe: 2.375 in [6.03 cm]
	Openhole logging: 3 in [7.62 cm]
Borehole size—max.	9.75 in [24.77 cm]
Outside diameter	2.125 in [5.4 cm]
Length	29.11 ft [8.87 m]
Weight	145 lbm [66 kg]
Tension	25,000 lbf [111,206 N]
Compression	Depends on the configuration and application

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