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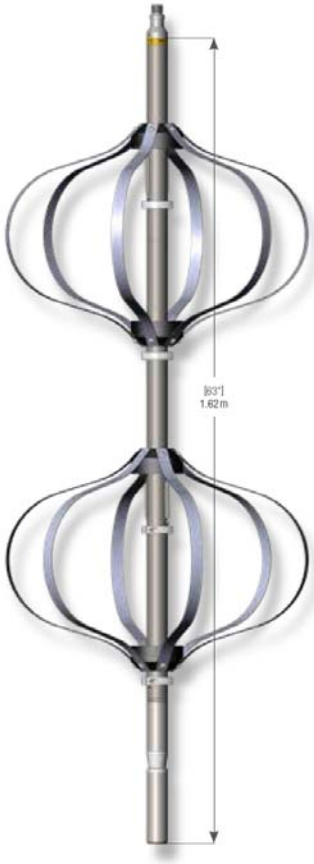
QL40ABI 2G . VLB

Acoustic borehole imager



The QL40ABI-VLB (Very Large Borehole) acoustic televiewer is specially designed to assess the integrity of large diameter wells. The tool is implementing the latest hardware/firmware generation to perform casing thickness measurement, corrosion evaluation and cement bond mapping in one run. The tool benefits from new 2G telemetry protocol optimizing logging speed on long single or multi-conductor wirelines.

The acoustic borehole imager records a 360° unwrapped image of the borehole wall. The tool emits an ultrasonic beam towards the formation and records the amplitude and the travel time of the reflected signal. Amplitude records are representative of the impedance contrast between rock and fluid. Travel time is used to determine accurate borehole diameter data, which makes the tool ideal for borehole deformation description, stress field analysis and casing inspection. A built in high precision orientation package incorporating a 3 axis fluxgate magnetometer and 3 accelerometers allows orientation of images to a global reference and determination of borehole azimuth[1] and inclination.
Sophisticated algorithms and real time processes are implemented to extend tool applications for casing thickness measurement, corrosion evaluation and measurement behind a PVC casing. In the QL40ABI-VLB additional algorithms compute the thickness of the casing and the cement distribution behind a steel casing (CADI). The CADI (Casing Amplitude Decay Index) represents a qualitative index related to the cement bonding.

The QL40ABI-VLB tool is a bottom sub in the Quick Link (QL) product line and can be combined with other QL40 tools to form a tool string or it can be run as a standalone tool.

[1] Only applicable in non magnetic environment

Application

CASED HOLE

- Casing inspection and corrosion evaluation
- Steel casing thickness
- Cement bond mapping - Qualitative cement bond analysis

OPEN HOLE

- Detailed and oriented caliper and structural information
- Borehole deformation (stress field analysis)
- Fracture detection and characterization
- Breakout analysis
- Lithology characterizations (Detection of thin beds, determination of bedding dip)
- Rock strength and fabric

Tool

- Diameter : 40mm (1.6")
- Length : 1.62m (63")
- Weight : 6.7kg (14.7 lbs)
- Temp : 0 - 70°C (32 - 158°F)
- Max. Pressure : 200bar (2900psi)

Acoustic sensor

- Acoustic sensor : Fixed transducer and rotating focusing mirror
- Focusing : Collimated acoustic beam
- Frequency : 1.2 MHz
- Rotation speed : Up to 20 revolutions per second - automatic
- Caliper resolution : 0.16mm (0.006")
- Samples per revolution : 72 in cased hole mode, 72, 144, 216 and 288 in open hole mode

Orientation sensor

- APS 544 - 3 axis fluxgate magnetometer – 3 accelerometers
- Inclination accuracy : +/- 0.5 degree
- Azimuth accuracy : +/- 1.2 degree

Operating conditions

- Cable type : Mono, multi-conductor, coax
- Compatibility : Scout / Opal (ALTlogger / Bbox / Matrix)
- Digital data transmission Telemetry : Variable baudrate telemetry according to cable length/type & surface system
- Logging speed : Variable - function of image resolution, borehole diameter, wireline and surface system model.
- Centralisation : Required
- Borehole fluid : Water, water based mud, brine, oil (oil based mud not applicable)
- Measurement range :
  Open hole : 2.5" to 20" (64 to 500mm) depending on mud conditions
  Cased hole[2] : 10" to 30" (254 to 760mm) minimum thickness 5 mm

[2] Scrape casing before operation

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Principle of measurement

The ABI produces images of the borehole wall which are based on the amplitude and travel time of an ultrasonic beam reflected from the formation wall. The ultrasonic energy wave is generated by a specially designed piezoelectric ceramic crystal and has a frequency of around 1.2MHz. On triggering, an acoustic energy wave is emitted by the transducer and travels through the acoustic head and borehole fluid until it reaches the interface between the borehole fluid and the borehole wall. By careful time sequencing the piezoelectric transducer acts as both transmitter of the ultrasonic pulse and receiver of the reflected wave. Travel time for the energy wave is the period between transmission of the source energy pulse and the return of the reflected wave measured at the point of maximum wave amplitude. Magnitude of the wave energy is measured in dB, a unitless ratio of the detected echo wave amplitude divided by the amplitude of the transmitted wave.
While most of the acoustic energy is reflected back to the tool the remaining acoustic energy propagates through the casing to the interface between the outer casing wall and borehole annulus where again reflection occurs. By recording and processing the full wave form of the echoes reflected from the casing the tool generates in real time four 360° unwrapped images: Travel Time, Amplitude, Thickness and CADI (Casing Attenuation Decay Index) giving a detailed view of the casing inner and outer condition, thickness and cement distribution.

Measurements features

Cased hole mode

- 360° unwrapped image of the steel casing based on travel time and amplitude records : caliper, amplitude, thickness and CADI image logs
- Deviation parameters : tilt, tool relative bearing, gravity

Open hole mode

- 360° unwrapped and oriented image of the borehole wall based on travel time and amplitude records : caliper and amplitude image logs
- Deviation parameters : azimuth, tilt, tool relative bearing, magnetic field, gravity
- 3 accelerometer calibrated components, 3 magnetometer calibrated components

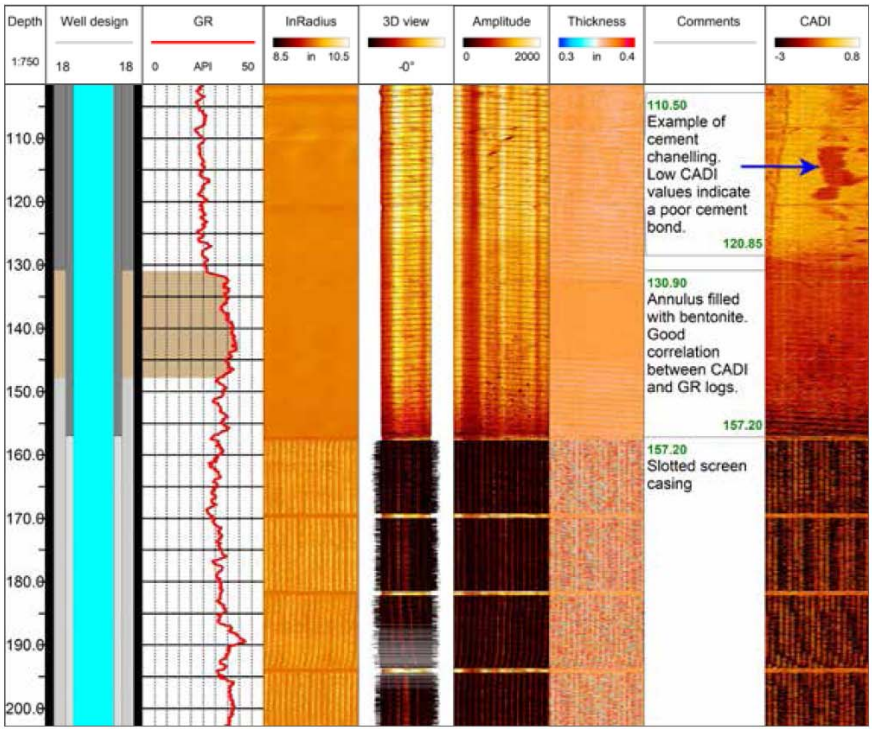
Behind PVC mode*

- 360° unwrapped and oriented image of the PVC casing and borehole wall based on travel time and amplitude records : caliper and amplitude image logs
- Deviation parameters: azimuth, tilt, tool relative bearing, magnetic field, gravity
- 3 accelerometer calibrated components, 3 magnetometer calibrated components

** PVC must be centered in borehole*

Reprocessing option (available as a service only)

The QL40-ABI2G-VLB offers the possibility to record in addition to the standard parameters 36 echo waveforms per acoustic trace during the data acquisition. The waveforms can be post-processed in the ALT office to optimize the computation of the Thickness and CADI by the mean of a dedicated ALT software.
This post-processing option is recommended when real time data quality is questionable due to borehole conditions (e.g. corroded casing wall) and in general to recover high quality Thickness and CADI data.



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