Superior longitudinal and peripheral cement evaluation using the Segmented Bond Tool (SBT)

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1. Introduction

The Segmented Bond Tool (SBT™) measures cement bond quality both vertically and laterally around the casing circumference. Quantitative measurements are made in six 60° segments around the casing, employing an array of 12 high-frequency, steered transducers, which are mounted on six pads. Each of the six motorized arms positions a transmitter and receiver pad against the interior wall of the casing. The short transmitter/receiver spacing of this instrument design makes the compensated attenuation measurements essentially independent of fast-formation effects.

A separate component of the instrument provides a "steered-beam" full-wave signature or variable-density display. The acoustic energy is directed in a manner emphasizing the effects at the cement-to-formation interface while minimizing casing effects.

Two log presentations are available at the well site. The Segmented Array presentation is an innovative format quantitatively displaying the six measured attenuations. A tool orientation trace identifies the segment on the low side of the casing. A quick and easy-to-read cement map with a five-level shading scale portrays the extent of cement bonding. The Primary Log presentation is similar to that of a conventional cement bond log, displaying both average and minimum attenuation curves (dB/ft), amplitude (mV), and amplitude ×5 (mV) traces. The VDL or signature presentation is also displayed. Gamma Ray, CCL, and Compensated Neutron instruments can be run in combination with the SBT and presented on the primary log.

The SBT is capable of logging in casing sizes from 4.5 to 16.0 in. (114 to 406 mm) and can be used in all types of fluids, including heavy mud and gas-cut borehole fluids. The SBT has also been run successfully in horizontal wells using tubing-conveyed methods. Centralization requirements for the SBT are less critical than for other cement evaluation logging devices. Measurements are unaffected by moderate tool eccentricity as long as pad contact is maintained with the interior casing wall.

Several SBT log examples are presented and evaluated. Log examples from two test wells with known, artificially created channels are also shown. These logs have confirmed laboratory experiments that demonstrate the SBT's ability to detect channels covering segments as small as 15°.