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Electro-Magnetic Defectoscope tool

Multi-casing evaluation

The **Electro-Magnetic Defectoscope (EMD) tool** uses transient electromagnetics to quantitatively measure up to four casing barriers and the presence or absence of a fifth barrier. The time-domain decay of the returning signal, caused by the electromagnetic diffusion through multiple barriers, determines metal thickness and anomalies in each barrier. The tool can be run in tubing or casing sizes from 2-3/8 to 20 in. (60.3 to 508 mm) at a logging speed of 15 ft/min (4.6 m/min).

The EMD tool identifies local reductions in casing wall thickness due to corrosion as well as mechanical wear including hard-to-detect wear situations like key seats. It also detects cracks, flaws, holes, zones of explosive perforation, and damage to sand screens. It will determine the presence of outer barrier collars and centralizers that can facilitate the selection of the window depth for sidetrack operations and plug setting depth. Different grades of material in the tubing or casing will exhibit different magnetic permeability and/or electrical conductivity. The EMD tool is able to identify defects in this challenging application.

The EMD tool features three sets of electromagnetic sensors that have maximum sensitivity to concentric metal barriers to provide multi-barrier evaluation capability without any influence of wellbore, annular fluids, or cement conditions. The three electromagnetic sensors provide short, medium, and deep depths of investigation. There are 126 unique multi-scale, multi-resolution, measured curves to provide unprecedented range and information.

Simultaneous inversion of all medium and deep curves provides outstanding robustness, stability, and accuracy of evaluation. The high-speed transient electromagnetic excitation allows the EMD tool to have a wider and denser spectrum of frequencies versus the standard multi-frequency electromagnetic tools. This improved spectrum provides better signal-to-noise ratio and enhances the tool response. All sensors and their channel curves are utilized for the interpretation to provide the most accurate results.

A key factor when managing well integrity involves monitoring how electrochemical corrosion affects a multi-barrier string over time. The

Applications

- Quantitative determination of thickness and corrosion of casing/tubing
- Multi-string casing evaluation
- Memory and slickline logging
- Onshore or offshore
- Vertical, deviated or horizontal wells
- Oil, gas, and water wells under operating conditions

Benefits

- Eliminates the need to pull tubing for evaluation
- Reduces time to log due to faster logging speeds
- Identifies casing defects including longitudinal cracks and transverse cracks and holes
- Provides temperature and pressure profile
- Detects presence/absence of fifth tubular
- Determines depth of sustained casing pressure

robustness of its measurements and interpretation makes the EMD tool especially adept at time-lapse monitoring of multiple barriers, optimizing well integrity intervention and workover operations.

The EMD tool also includes data from gamma ray, pressure, and temperature sensors. The gamma-ray sensor provides depth correlation of the EMD logs. Pressure data can be used to evaluate borehole fluid contacts or perform a gradient survey, and temperature data can potentially identify annular fluid flow.

The EMD tool can be combined with other Sondex well integrity services including the spectrum Noise Tool (NTO), Multi-finger Imaging Tool (MIT) caliper log, Radial Bond Tool (RBT) and Production Logging Tools (PLT).

To learn more about how the EMD tool will provide maximum understanding of your wellbore integrity, contact your Sondex representative or visit Sondex.com.

Specifications

Analysis	Individual thickness for up to 4 tubing/casing layers, damage profile, wall loss, gamma ray depth correlation, pressure profile, temperature profile
Maximum diameter of the investigated pipes	20 in. (508 mm)
Minimum diameter of the investigated pipes	
With centralizers	2-⅜ in. (60.3 mm)
Without centralizers	2-½ in. (52.1 mm)
Maximum thickness of a single pipe	0.63 in. (16 mm)
Maximum total thickness of four barriers	2-in. (50.8 mm)
Absolute error of measurement of pipe wall thickness	
First barrier	±0.02 in. (±0.5 mm)
Second barrier	±0.028 in. (±0.7 mm)
Third barrier	±0.15 times the barrier thickness
Fourth barrier	±0.2 times the barrier thickness
Minimum length of a defect "crack" type along the tubular axis	
Single pipe	0.08 times the perimeter
Second pipe	0.25 times the perimeter
Third barrier	0.33 times the perimeter
Fourth barrier	0.50 times the perimeter
Minimum length of a defect crack type	
Single pipe	0.14 times the perimeter
Tool	
Outside diameter	1.69 in (43 mm)
Length	22.28 ft (6.79 m)
Maximum pressure rating	14,500 psi (100 MPa)
Maximum temperature rating	300°F (150°C)
Weight (in air)	52.7 lb (23.93 kg)
Maximum logging speed	15 ft/min (4.6 m/min)
Number of EM sensors	3 (short, medium, long)
Measurement mode	Real time or memory
Additional measurements	
Temperature sensor resolution	0.018°F (0.01°C)
Pressure sensor resolution	7.4 psi (0.5 atm)
Gamma-ray range	30 – 1000 API (3 – 100 µR/hr)

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