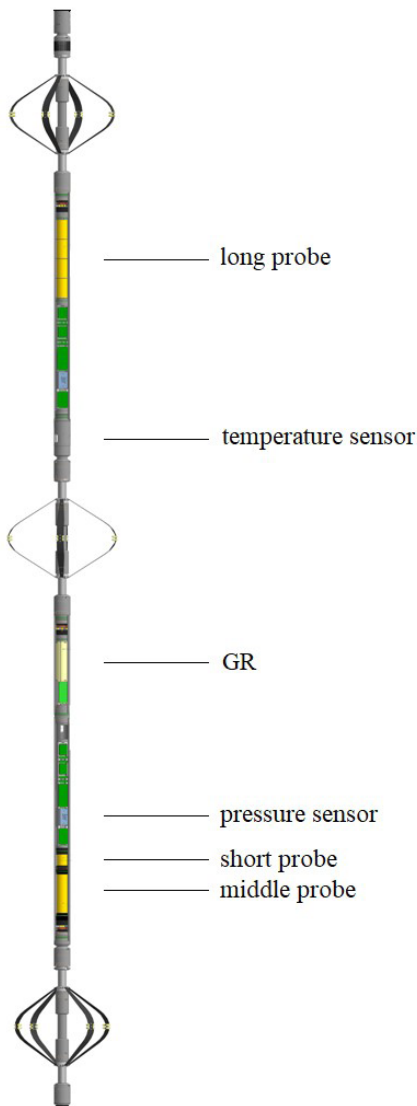


Cased hole

MID-4 Electro-Magnetic Defectoscope – Thickness Gauge for Multi-String Operations



SCOPE OF APPLICATION

Casing string and tubing integrity monitoring in killed and non-killed oil and gas wells of multi-string structure

FEATURES AND ADVANTAGES

In newly drilled wells MID-4 tool is used for monitoring:

- well design up to five casing barriers evaluation
- compliance with the project of casing string set point with different diameters and wall thickness
- liner setting interval
- casing integrity and degree of wear during tool operation

In operating wells the MID-4 tool makes it possible to determine:

- perforation intervals
- location of through defects
- parting of casing in four-string structure
- actual installation intervals of sealing patches
- actual installation depth of casing packers, etc
- well design up to five casing strings
- corrosion intervals and degree of casing string wear
- intervals of casing defects for repair
- thickness of the 1st, 2nd, 3rd, and 4th columns

The tool includes 3 probes of defectoscope-thickness gauge, highly sensitive temperature sensor, gamma-ray and pressure sensors.

Cased hole

MID-4 Electro-Magnetic Defectoscope –Thickness Gauge for Multi-String Operations

SPECIFICATIONS

Max.diameter of the investigated pipes, mm	508
Number of investigated pipes	1; 2; 3; 4
Min.diameter of the investigated pipe, mm	60
Max.total thickness of four barriers, mm	50,8
Measurement accuracy of pipe wall thickness, mm	
first barrier	±0,5
second barrier	±0,7
third barrier	0,15 times the barrier thickness
fourth barrier	0,2 times the barrier thickness
Min.length of a defect “crack” type along the pipe axis, mm	
single pipe	1/12 of the perimeter
second pipe	1/4 of the perimeter
third barrier	1/3 of the perimeter
fourth barrier	1/2 of the perimeter
Min.length of a defect “transverse crack” type for a single pipe	1/7 of the perimeter
Temperature sensor resolution, °C	0,01
Time constant of the thermometer, sec.	0,5
Operation temperature, °C	-10 to 150
Max.temperature rating, MPa	100
Overall dimensions of tool, mm:	
- diameter / length	42/6735

Case Study No.1

MID-4 Magnetic Impulse Defectoscope for work in multi-column wells

Task: Determine the technical condition of steel casings and tubing in an open multi-column oil well (4 pipes)

Calculation for multi-column structures allows to evaluate the effect of the casing on the results of the tubing study and to evaluate the shielding effect of the tubing in the study of the EC, as well as to evaluate the mutual influence of the pipes in the three-column well. When examining an EC, it is often necessary to take into account the influence of a liner.

The capabilities of conventional flaw detectors do not allow detecting pipe defects for 3rd and 4th columns.

Solution: Using a magnetic impulse defectoscope MID-4 to work in multi-column wells

MID-4 is used for evaluation of drilled wells to control the design of a well of up to five strings, compliance with the design intervals for installing strings with different diameters and wall thicknesses, the interval for installing liners, the degree of wear, and determining the integrity of the string during drilling.

In operating wells, the MID-4 equipment makes it possible to determine: perforation intervals, location of through faults, parted strings in a four-string wells, actual intervals of sealing patches, casing packers, etc., well design for up to five strings, corrosion intervals and degree of column wear, intervals of column failure requiring repair, the thickness of the first, second, third and fourth columns.

Result: Violation of the integrity of the conductor and corrosion in the liner were determined.

In the highlighted interval (track 4) (see figure), a decrease in the signal amplitude was found in late channels, which indicates corrosion and a defect in the 3rd and 4th pipe strings.

Intensive corrosion in the liner was determined (track 9, displays the thickness of the 3rd casing). Violation of the integrity of the conductor was determined (track 10, displays the thickness of the 4th column).

Advantages

In newly drilled wells MID-4 is used for monitoring:

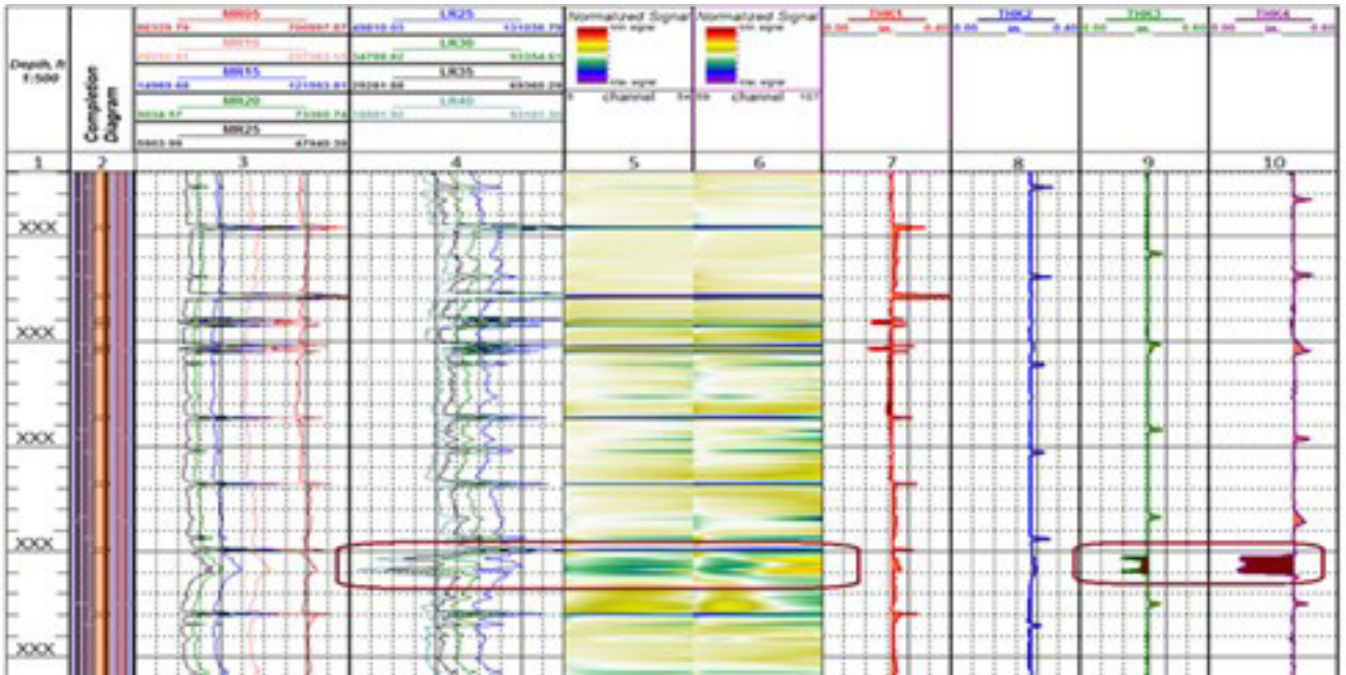
- Well design of up to five strings
- Casing string integrity and the degree of wear during operation of the tool

In operating wells MID-4 enables to determine:

- Casing parting in a four-string well structure
- Well design of up to five strings
- Thickness of the 3rd and 4th strings

Key Benefits

- Obtaining the full set of parameters in one trip
- No need in well shut down



Track 1 - depth.

Track 2 - well design (according to MID-4 results)

Track 3 - middle probe measurement data

Track 4 - measurement data of a long probe. In the selected interval, a decrease in the signal amplitude in late measurements, which indicates corrosion and a defect in the 3rd and 4th pipe strings

Tracks 5, 6 - defectograms of long and short probes

Track 7 - tubing thickness

Track 8 - thickness of the 2nd pipe

Track 9 - thickness of the 3rd pipe (intense corrosion in the liner is determined)

Track 10 - thickness of the 4th pipe (violation of the integrity of the conductor was determined)