

MagniSphere high-definition NMR logging-while-drilling service

Real-time NMR data improves petrophysical evaluation to better place wells in pay zones

Applications

Drilling through complex lithology

How it improves wells

MagniSphere* high-definition NMR logging-while-drilling service provides sourceless, real-time NMR data for accurate and precise reservoir characterization, which improves well placement for more productive hydrocarbon extraction from extended-reach wells.

- Better understand producibility in complex reservoirs—flow or no flow
- Deliver lithology, independent porosity, irreducible and producible fluid volumes, pore size distribution, and continuous permeability in complex reservoirs
- Identify optimal location to perforate the lateral section to produce the most oil while avoiding water
- Improve the reservoir model

How it works

MagniSphere service is real-time NMR while drilling, simultaneously delivering T_1 and T_2 distributions, which measure the time it takes for formation fluid hydrogen nuclei to polarize and relax after being stimulated with a combination of magnetic fields. This enables optimal characterization of heavy and light fluids with an equal level of accuracy within the widest range of rock fabrics.

The T_2 distribution gives a better definition of fast-relaxing fluids—those with very short T times. It also provides good definition of characteristics such as microporosity and heavy oil. T_2 distribution has a faster acquisition time, so it enables better data statistics and precision.

T_1 distributions help characterize slower-relaxing fluids, or fluids that are on the high end of the T time, which characterizes large pores, macroporosity, light oil, and gas. Although T_1 is a longer measurement and is ROP sensitive, it has a better tolerance to lateral motion.

Because T_2 distribution has accuracy on one type of fluid and specific bore size, and T_1 distribution on a different type of fluid and pore size, having both simultaneously enable the characterization of a wider range of fluid types in a broader range of rock fabric.

MagniSphere service features an “intelligent” processing workflow that enables automated wellsite data delivery with very short turnaround times, improving decision making during time-sensitive operations.

Mechanical Specification	
Hole size, in	5 $\frac{7}{8}$ –6 $\frac{3}{4}$
Nominal collar OD, in	4.75
Length, ft	31.26
Air weight, lbm	1,740
Thread connection (downhole and uphole)	NC38 box
Joint yield torque, lbf	18,200
Max operating pressure, psi	25,000
Max operating temperature, degF	302
Max flow rate, galUS/min	400
Pressure drop (PD)	$C^\dagger = 6,207$ for medium-flow kit (230–310 galUS/min) $C = 7,649$ for high-flow kit (260–360 galUS/min) $PD = MW^\ddagger (\text{lbm/galUS}) \times Q^\S^2 (\text{galUS/min}) / C$
Max. dogleg sliding, °/100 ft	30
Max dogleg rotating, °/100 ft	15
Power source	Mud-lubricated turbine
Stabilizer 1	
Distance to tool bottom, ft	0.7
OD, in	5.75–6.625
Total flow area, %	22–32
Stabilizer 2	
Distance to tool bottom, ft	13.5
OD, in	5.75–6.625
Total flow area, %	14–23
Measurement Specification	
Sensor to tool bottom, ft	2.58
Measurement distribution	T_1 and T_2
Mud resistivity, ohm.m	≥ 0.01
Echo spacing, us	400
Diameter of investigation, in	10
Magnetic field gradient, g _n /cm	2.5
Range of measurement	
Porosity, %	0–100
T_1 , ms	0.5–8,000
T_2 , ms	0.5–8,000
Vertical resolution	
Static (antenna aperture), in	2.5
Dynamic, ft at ft/h	2 at 50 4 at 100
Measurement precision, pu	1

[†] Constant

[‡] Mud weight

[§] Square of drilling flow value Q