Focused Magnetic Resonance Tool

Provides accurate porosity, fluid saturation, and pore-size distribution at multiple depths of investigation

Applications

- Lithology-independent porosity
- Fluid identification and saturation
- Hydrocarbon characterization and viscosity
- Moveable-hydrocarbon identification in laminated, low-contrast, complex-lithology, and unconventional reservoirs
- Permeability index
- Capillary pressure

Features and Benefits

- Minimizes borehole effects while maximizing formation response with an eccentered sidewall-focused design and high-efficiency antenna
- Delivers precise data in high-salinity mud (0.02 ohm-m) and large boreholes without a mud excluder
- Enables radial saturation profiling with multifrequency operation
- Maximizes multidimensional-inversion response and accuracy by incorporating unique acquisition sequences that provide enhanced fluid identification and characterization
- Offers a unique pre-job planning process that selects the acquisition sequence to client requirements and the wellbore environment
- Provides stationary measurements via comprehensive activation sequences
- Yields spectra for T1 and T2 at the wellsite, and provides single-pass data for advanced post-processing, including 2D inversion for T1, T2, and diffusion constant
- Offers variable logging speeds depending on the selected activation sequence

Tool Description

The focused magnetic resonance (FMR) tool provides accurate porosity, fluid saturations in the flushed zone, and pore-size distribution* at multiple depths of investigation. Based on the same principles used in medical magnetic resonance imaging technology (MRI), the FMR offers unique acquisition sequences that both quantify and characterize rock and fluid types.

Post processing of FMR tool data provides critical rock and fluid information, including porosity, pore-size distribution, permeability, viscosity, capillary pressure, hydrocarbon type, and saturation.

The Weatherford focused magnetic resonance (FMR) tool provides a complete nuclear magnetic resonance (NMR) formation-evaluation solution.

Weatherford®

* For water wetting phase

Focused Magnetic Resonance Tool

Specifications

Measurement

Data	Porosity; porosity partitioning; T1 and T2 spectra
Depth of investigation	1.68 in. (4.3 cm) to 4.27 in. (10.8 cm)
Antenna aperture	18 in. (45.7 cm)
Minimum echo spacing	0.4 ms
Number of frequency bands	16
Measurement range	Porosity: 0 to 100 pu T1 and T2 spectral range: 0.1 to 20,000 ms
Accuracy	Total NMR porosity: ±1 pu at BHT

Mechanical

Diameter	Sonde: 5 in. (12.7 cm) Electronics: 4.25 in. (10.8 cm) Energy cartridge: 3.38 in. (8.6 mm)
Length	23.5 ft (7.16 m)
Weight	780 lb (326.6 kg)
Maximum temperature	350°F (177°C)
Maximum pressure	20,000 psi (138 MPa)
Minimum hole size	5.875 in. (14.92 cm)
Maximum hole size	No limit
Minimum mud resistivity	0.02 ohm-m

Answer Products

Field deliverables	Total porosity
	Permeability index
	Porosity partitions (free, capillary, and clay-bound fluids)
	T1 and T2 spectra
Standard interpretation	Magnetic resonance porosity: permeability analysis
	Porosity partition: permeability index adjusted by T2 cutoff (free, capillary, and clay-bound fluids)
	Rock quality index
	Calibrated permeability
Advanced interpretation	Fluid identification and saturations
	Petrophysical analysis
	Oil viscosity analysis
	Under-called porosity (gas, TOC, heavy oil)

Weatherford®