

LithoStar™ Service

INTEGRATED POROSITY IMAGING FOR ACCURATE RESERVES CALCULATIONS AND GEOLOGICAL AND PETROPHYSICAL INTERPRETATIONS

OVERVIEW

Formation density is a key petrophysical measurement for understanding the porosity of your reservoir. The LithoStar™ service from Sperry Drilling makes wireline-quality density measurements while drilling. Real-time density borehole images, in both oil-based and water-based mud systems, provide a detailed understanding of the geological structure. The LithoStar service also provides accurate measurements of formation neutron porosity, helping to distinguish between fluid types. The LithoStar service provides petrophysical and geological insight throughout the well-construction process.

HIGH ACCURACY AT THE RIGHT TIME FOR BETTER DECISIONS

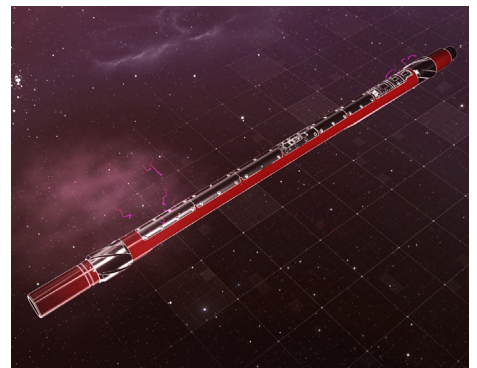
The advanced downhole processing algorithms used by the LithoStar service deliver high-accuracy and high-precision measurements while drilling—before significant borehole degradation or fluid invasion can occur. This gives the best picture of the true formation properties. With the borehole in its best condition, porosity determination is enhanced leading to improved reserves calculations.

GEOLOGICAL AND LITHOLOGICAL INSIGHT

Density and photoelectric (Pe) absorption borehole images let you understand your lithology and structural dip regardless of borehole orientation. Real-time structural dip interpretation leads to better geosteering decisions to accurately place the well in the target zone. The image logs reveal borehole shape and hole spiraling and can help assess stress-induced breakout and mitigate borehole stability issues.

GAS DETECTION AND REAL-TIME FLUID TYPING

Integrated density and thermal neutron porosity measurements detect and evaluate gas-bearing formations and determine lithology and porosity in structurally complex geological environments. With the LithoStar service, you can improve your real-time decision making and gain a clearer understanding of the petrophysical and geological characteristics of your reservoir.



BENEFITS

- » Improve reserves calculations
- » Determine lithology with Pe measurements and images
- » Refine the earth model by measuring structural dip in real time
- » Optimize wellbore placement through precise geosteering
- » Acquire real-time formation images in oil-based or water-based mud systems
- » Improve understanding of mechanical rock properties
- » Delineate complex lithologies and identify target zones in real time
- » Evaluate gas-bearing formations

FEATURES

- » Wireline-quality density measurements
- » Integrated formation density, neutron porosity, and ultrasonic standoff measurements
- » Azimuthal density and porosity images
- » Comprehensive corrections in any downhole environment

LithoStar™ Service Technical Specifications

Mechanical Specifications	4.75 inch	6.75 inch	8.00 inch
Nominal Tool OD	4.75 in. (121 mm)	6.75 in. (171 mm)	8.00 in. (203 mm)
Maximum Body OD	5.25 in. (133 mm)	7.25 in. (184 mm)	10.60 in. (269 mm)
Available Stabilizer Blade Diameters	5.75 in. (146 mm)	8.25 in. (210 mm)	12 in. (305 mm)
Hole Size Range	5.875 in. to 6.75 in. (149 mm to 171 mm)	7.875 in. to 9.875 in. (200 mm to 251 mm)	10.50 to 14.75 in. (266.7 to 374.7 mm)
Collar ID	1.25 in. (31.8 mm)	2.00 in. (50.8 mm)	2.36 in. (60 mm)
Length	15.46 ft (4.71 m)		15.61 ft (4.71 m)
Weight	1014 lbm (460 kg)	2000 lbm (907 kg)	3260 lbs (1480 kg)
Connections	HAL40 (box up x pin down)	HAL50 (box up x pin down)	HAL56 (box up x pin down)
Make-Up Torque	14,000 ft.lbf (1900 daN·m)	35,000 ft.lbf (4750 daN·m)	50,000 ft.lbf (6780 daN·m)
Maximum Dog Leg Severity - Rotating	14°/100 ft (14°/30 m)	10°/100 ft (10°/30 m)	8°/100 ft (8°/30 m)
Maximum Dog Leg Severity - Sliding	30°/100 ft (30°/30 m)	21°/100 ft (21°/30 m)	14°/100 ft (14°/30 m)
Maximum Drilling or Operating Rotary Torque	12,000 ft.lbf (1630 daN·m)	35,000 ft.lbf (4750 daN·m)	50,000 ft.lbf (6780 daN·m)
Operating Limits			
Temperature Range	32 to 302°F (0 to 150°C)		
Maximum Pressure	25,000 psi (172 MPa)		
Maximum Mass Flow Rate	5,000 lbm/min (2270 kg/min)	10,000 lbm/min (4540 kg/min)	20,000 lbm/min (9070 kg/min)
Maximum Sand Content	2%		
Maximum Rotary Speed	400 RPM		
Maximum WOB	25,000 lbf (11 000 daN)	65,000 lbf (29 000 daN)	85,000 lbf (38 000 daN)
Vibration	Refer to Sperry Drilling Downhole Tools Technical Specifications. (Available on request.)		

LithoStar™ Service Technical Specifications continued

Measurement Specifications	4.75 inch	6.75 inch	8.00 inch
Density			
Measurement Type	PMT Scintillation Detectors		
Measurement Range	1.0 to 3.1 g/cc		
Measurement Accuracy	± 0.010 g/cc (2.1 to 2.8 g/cc) ± 0.015 g/cc (1.0 to 2.1 g/cc and 2.8 to 3.1g/cc)		
Measurement Vertical Resolution	90% value: 6.0 in. (152 mm)		
Measurement Statistical Repeatability (1σ)*	± 0.006 g/cc	± 0.010 g/cc	± 0.015 g/cc
Measure Point from Bottom of Collar	4.52 ft (1.38 m)	4.30 ft (1.31 m)	4.39 ft (1.34 m)
Photoelectric Factor			
Measurement Range	0 to 10		
Measurement Accuracy	± 0.15		
Measurement Statistical Repeatability (1σ)**	± 0.06		
Measure Point from Bottom of Collar	4.52 ft (1.38 m)	4.30 ft (1.31 m)	4.14 ft (1.26 m)
Ultrasonic Standoff			
Measurement Type	Piezoelectric Transducer		
Measurement Range	Up to 4 in. (mud weight dependent)		
Measurement Accuracy	± 0.05 in. (1.27 mm)		
Measure Point from Bottom of Collar	8.26 ft (2.52 m)	8.16 ft (2.49 m)	8.18 ft (2.49 m)
Neutron Porosity			
Measurement Type	Helium-3 Tubes		
Measurement Range	0 to 100 p.u.		
Measurement Accuracy	± 0.5 p.u. from 0 to 10 p.u. ± 5% from 10 p.u. to 50 p.u.		
Measurement Vertical Resolution***	10 in. (254 mm)		
Measurement Statistical Repeatability (1σ)**	± 0.9 p.u. @ 30 p.u.		± 1.2 p.u. @ 30 p.u.
Measure Point from Bottom of Collar	11.71 ft (3.57 m)		12.52 ft (3.82 m)

* Specifications are for a 30-second sample in a 2.2-g/cc formation.

** Specifications are for a 30-second sample period

*** Vertical resolution is the bed thickness in which the deflection of the measurement is 75% of the true difference in porosity between the target bed and the shoulder beds; this specification assumes a 40 p.u. target bed and 20 p.u. shoulder beds.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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