

MicroScope HD 675

Resistivity and high-definition imaging-while-drilling service

APPLICATIONS

- High-resolution petrophysical evaluation for improved reserve estimates
 - Thin-bed analysis
 - Azimuthal measurements for high-angle well evaluation
- Fine-scale geological interpretation
 - Fracture characterization
 - Structural analysis
 - Heterogeneity quantification
- Real-time interpretation
 - Well placement optimization
 - Wellbore stability information

BENEFITS

- Saves rig time
- Provides multidepth high-resolution azimuthal laterolog resistivity arrays that cover the same formation volume as density and neutron measurements for improved petrophysical evaluation
- Improves geological interpretation
- Enhances well placement in complex environments
- Enables drilling parameter optimization and real-time wellbore stability analysis

FEATURES

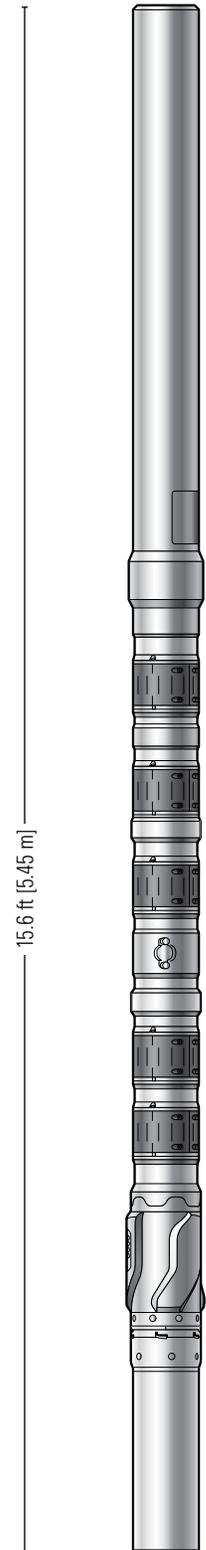
- High-definition imaging with 0.4-in button size and 0.125-in × 0.25-in pixel resolution
- Multidepth (4) high-resolution images with full borehole coverage
- Four azimuthally focused electrode resistivity measurements
- At-bit and mud resistivity
- Measurement of inclination, shocks, and temperature

The MicroScope HD* 675 resistivity and high-definition imaging-while-drilling service extends the capability of high-resolution resistivity and imaging gained with the industry-leading MicroScope HD 475 service to the 8.5-in hole size. The MicroScope HD service provides driller-friendly high-definition (LWD) imaging for reservoir description, from structural modeling to detailed fabric characterization in conductive drilling fluids.

With a pixel resolution of 0.25 in × 0.125 in, the MicroScope HD service enables operators to interpret fine-scale formation features in the downhole environment. The high-definition resistivity images are available in both real-time and recorded modes. Image interpretation is supported by a wide range of answer products via the Techlog* wellbore software platform, including the Techlog Wellbore Imaging module and the Advanced Borehole Geology Suite of plug-ins. MicroScope HD service images enable dip analysis and fracture characterization (from automated segment picking to aperture calculations) for geological interpretation of structurally complex reservoirs. Additionally, detailed fabric information can be quantified using image-based heterogeneity evaluation, secondary porosity determination, and thin-bed analysis. This service improves geological interpretation in siliciclastics, carbonates, and unconventional shale oil and gas reservoirs. High-definition images from the MicroScope HD service enable recognition of borehole breakouts and drilling-induced fractures that provide valuable information about borehole stress orientations and help optimize drilling and completion programs.

The MicroScope HD service also includes a high-resolution array of laterolog resistivity measurements. These cylindrically focused measurements are acquired using a unique two-button design which enables full borehole coverage over a large range of ROP and rpm variations. Quantitative resistivities are available as an around-hole average, oriented quadrants, and sector images with resolution to the subinch scale (depending on conditions). Quadrant data enable confident determination of layer resistivities in both thin dipping layers and high-angle wells. In addition, the range of depth of investigation of the array of resistivities covers a volume similar to nuclear measurements (density, neutron, and nuclear magnetic resonance) and therefore removes ambiguity from petrophysical interpretations. Invasion inversions are available for both average and quadrant arrays.

In addition to high-resolution button resistivity measurements, at-bit resistivity measurement are also obtained. These data enable operators to respond to changes in formation resistivities at or near the bit and are used for the selection of coring and casing points.



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General Specifications

Hole size,† in [mm]	8½ in to 9⅞ in [216 mm to 250 mm]
Tool Length and Weight	
Length	15.6 ft [5.45m]
Weight	1,750 lbm [800 kg]
Collar Dimensions	
Nominal diameter, API	6¾ in [175.26 mm]
Maximum diameter	6⅞ in [175.90 mm]
Top thread connection	5½ FH box
Bottom thread connection	5½ FH box
Maximum operating temperature	302 degF [150 degC]
Power supply	MWD turbine power
Downhole Memory	
Capacity	1.5 GB
Recording time (standard definition)	700 hours
Recording time (high definition, 100 rpm)	300 hours
Combinability	Fully combinable with all Schlumberger tools

Mechanical Specifications

Dogleg Severity	
Rotary mode	8°/100 ft [8°/30 m]
Sliding mode	16°/100 ft [16°/30 m]
Hydraulics	
Maximum operating pressure	20,000 psi [137,895 kPa]/25,000 psi [172,369 kPa] optional
Flow range	0–800 galUS/min [0–3.03 m³/min]
Pressure drop constant (C)‡	55,000
Maximum sand content	3% by volume
Lost circulation material tolerance	Medium nut plug, 50 lbm/galUS [23 kg/0.004 m³]
Maximum system shock level	30 min at Shock Level 3 (50 g _n) or cumulative 200,000 shocks above 50 g _n
Tension	330,000 lbf
Compression	80,000 lbf
Torque	16,000 ft.lbf

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Measurements Specifications

Resistivity	Bit, azimuthal button, and toroid			
Range	0.2–20,000 ohm.m			
Button resistivity accuracy [§]				
0.2–250 ohm.m	±5%			
250–500 ohm.m	±10%			
500–1000 ohm.m	±20%			
Toroid resistivity accuracy				
0.2–2,000 ohm.m	±5%			
2,000–5,000 ohm.m	±11%			
5,000–10,000 ohm.m	±22%			
Mud resistivity				
Range	0.01–20 ohm.m			
Accuracy				
0.01-0.03 ohm.m	±12%			
0.03-3 ohm.m	±8%			
>3 ohm.m	±5%			
Azimuthal GR				
Range	0-1,000 gAPI			
Accuracy	±5%			
Statistical resolution	±5% gAPI at 100 gAPI and 200 ft/h [61 m/h]			
Axial resolution	10 in			
Button resistivity response	Extra-deep	Deep	Medium	Shallow
Depth of investigation	7 in	5 in	3 in	1.5 in
Axial resolution ^{††}	¾ in	¾ in	¾ in	¾ in
Bit and toroid resistivity response	Bit	Extra-deep toroid		Deep Toroid
Depth of investigation	30 in	6 in		5 in
Axial resolution	48 in ^{††}	15 in		15 in
Image resolution	Extra-deep	Deep	Medium	Shallow
Axial resolution ^{§§}	1½ in	1½ in	1½ in	1½ in
High-definition Imaging				
Button size or vertical resolution	¾ in			
Pixel size	½ in × ⅛ in			
Azimuthal bin count	208			
Coverage	Full borehole coverage at 300 ft/h and 60 rpm			
Depth correction	Available up to 300 ft/h and 120 rpm			
Maximum instantaneous rpm for high-definition imaging	290			

[†] MicroScope HD 675 service imaging sleeve only for 8½-in hole size.

[‡] Pressure drop (psi) equals [mud weight (lbm/galUS) 2 × flow rate (galUS/min) 2]/C

[§] For $R_{mud} > 0.04$ ohm.m.

^{††} Thickness of a 1-ohm.m feature in a 10-ohm.m background for which 90% of the formation resistivity value at the center of the bed is measured. Axial resolution, or along-tool-axis resolution, was previously referred to as vertical resolution for logging measurements acquired in vertical wells.

^{†††} For bit electrode length of no more than 30 ft.

^{§§} Thickness of a 1-ohm.m feature in a 10-ohm.m background for which 10% of the resistivity contrast is measured.