



CASED HOLE LOGGING

Multiphase Array Production Logging Tool

Spartek Systems specializes in providing the oil and gas industry with high quality data to monitor well performance and diagnose potential problems. Founded in 1994, Spartek Systems leads the industry in providing cost effective solutions for acquiring reliable production data.

Product Overview

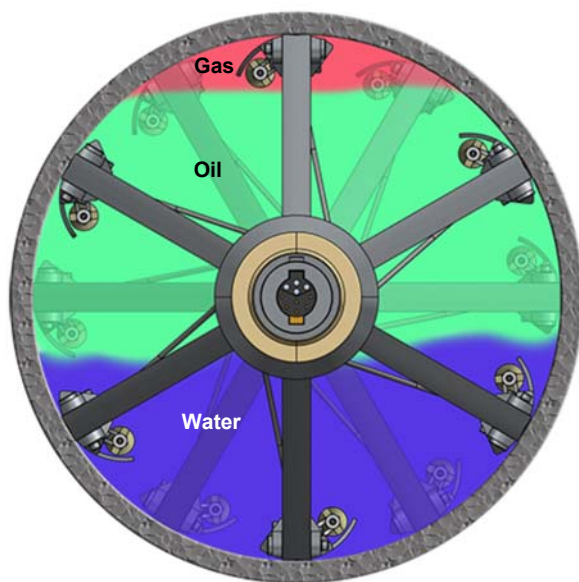
The Multiphase Array Production Logging Tool has been designed to address the deficiencies in the first generation of production logging tools targeted for quantifying multiphase flow in highly deviated or horizontal wells. The platform utilizes a circumferential array of six Multi-Sensor Arms. Each Arm makes the following measurements:

- ▶ Water Holdup: Capacitance, Resistivity
- ▶ Gas Holdup: Acoustic Density
- ▶ Flow: Spinner, Fast Response Temperature

These measurements are made just below the arms, near the casing wall, providing a complete profile of the fluids across the wellbore. The sensors are all in close proximity, ensuring that you are measuring both phase and velocity in real time over the measurement interval.

Water Holdup

In order to differentiate between water and hydrocarbons (oil or gas), the system employs an array of six "two electrode" capacitance sensors and six "four electrode" micro resistivity's sensors. The



combination of these sensors provides a quantitative water hold up measurement. And though correlation techniques can be used to provide velocity data.

Gas Holdup

To differentiate between liquids and gas, a proprietary sensor has been developed that measures the density of the fluid. This provides a very high contrast between liquids (oil or water) and gas. An array of six of these sensors are positioned circumferentially around the well bore providing localized identification of gas holdup.

Flow Velocity

On each of the six arms, there is a small diameter turbine flow meter to measure the local flow velocity. The flow meter uses jewel bearings and a low mass impellor to improve sensitivity. In addition to the flow meter a fast response RTD is also available to monitor small changes in temperature due to

Features and Applications

- ▶ Multiphase flow profiling in highly deviated and horizontal wells
- ▶ Identification of fluid and gas entries.
- ▶ Improved reliability and measurement integrity over first generation multiphase flow tools.
 - All sensor measurements are simultaneous at the same depth interval.
 - Arm radial position is "settable".
 - Combinable with one or more MAPLT and other "Open Architecture" Spartek Tool Bus tools.
 - Tool rotation improves coverage and provides measurement redundancy.
 - Integrated RB Sensor for orientation information.
 - Cross correlation velocity measurements.
 - Multiple fluid ID measurements for improved redundancy.

SPARTEK SYSTEMS

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Specifications:

Operating Specifications	
Pressure rating	15,000 psi [103,425 kPa]
Temperature rating	350°F [177°C]
Corrosion Resistance	NACE MRO175
Tool Diameter	2.13 inch [54 mm], 1.688 inch [42.9 mm]
Tool Length	OAL Make Up
	6.36 ft [1.94 m] 6.16 ft [1.88m]
Tool Weight	50 lb [22.68 kg] (2 1/8" Diameter)
Hole Size	Up to 7.0 inch [177.8 mm]
Minimum Restriction	2.28 inch [57.9mm], 1.81 inch [46mm]
Sensor Specifications	
Spinner	
Range	± 200 rps
Operating Diameter	2.25 in [2.13 in] minimum 1.81 in [1.69 in] minimum
Resolution	0.333 rps
Accuracy	± 2%
Threshold	4-6 ft/min (oil flow)
Temperature	
Range	-40°F to 350°F [-40°C to 177°C]
Resolution	0.0018°F [0.001°C]
Accuracy	± 1.8°F [± 1°C]
Fluid Capacitance	
Resolution	0.1%
WHI Accuracy	2% (range 0% - 30%) 5% (range 30% - 60%)
Fluid Resistivity	
Resolution	< 0.1 ohm m
Accuracy (larger of)	± 1% of Reading or ± 0.03 Ohm m
Gas Holdup	
Sensor	Acoustic Densitometer
Range	0 - 1.4 g/cc
Resolution	± 0.002 g/cc
Accuracy	± 0.04 g/cc

Specifications subject to change without notice

Six Arm Circumferential Array



Two Electrode Capacitance

Four Electrode Micro-Resistivity



Acoustic Densitometer

Fast Response Temperature



Offset Miniature Turbine Spinner



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