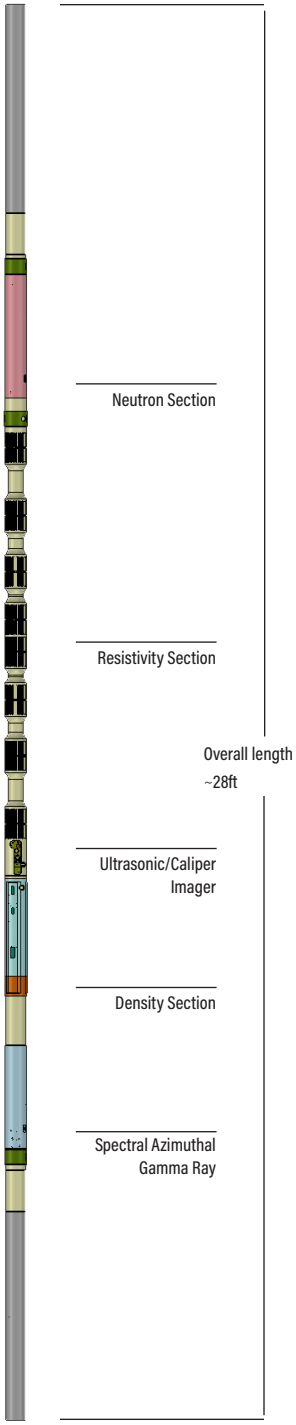
GEO EDGE

COMPACT INTEGRATED TRIPLE COMBO LOGGING TOOL

The Geo Edge is a new generation Logging While Drilling (LWD) tool from Innovative Downhole Solutions. This integrated triple combo tool combines an industry leading spectral/azimuthal gamma-ray, propagation resistivity, ultrasonic imager/caliper, neutron porosity and caliper-corrected azimuthal density in one compact collar.

- Resistivity/Spectral Azimuthal Gamma Ray/Neutron Porosity/Density/Ultrasonic Imager/Caliper in one 28 ft (8.5m) collar.
- 4 ¾" and 6 3/4" sizes
- Equal or better measurement accuracy and statistical precision versus the current market
- Superior image quality from azimuthal density, azimuthal gamma, and azimuthal caliper and ultrasonic imager
- Can be assembled and tested in the workshop, with no assembly required at rig site.
- Logging memory capacity +7 days (168 hrs) at the maximum data storage rate.
- Seven days operating time using three standard 26 amp.hr batteries (30 ft collar).
- Compact high-capacity battery section can be provided in a 15 ft (4.5m) collar.
- Batteries can be disabled with a plug for shipping and long-term storage



FEATURES & BENEFITS

All in One Multi-Function Tool

- Heli-portable: The whole BHA can be transported in single lift
- Reduces variable deck load and deck space offshore.
- Reduced footprint for smaller drill sites onshore.
- Minimizes BHA handling – time savings and HSE considerations.

Easy Access for tools maintenance

- Designed for efficient and cost-effective maintainability.
  - o Electronics PCBs are easily replaceable.
  - o Resistivity antennas are accessible for repair or replacement.
  - o Density, Gamma ray, and Neutron packages which are easily accessible.

Provides real-time data transmitted to surface via system related mud pulse telemetry

- Compatible with existing generation Positive Pulse MWD, via a translator module.
- Geo-steering service for optimized wellbore placement.

Utilizes industry standard 2 MHz and 400 kHz transmitted frequencies for Propagation Resistivity measurement

- Operates and provides formation evaluation capability in all mud types.
- Provides twelve resistivity measurements compensated for borehole and temperature effects in real time or memory.

Rugged, integral antenna design and fully digital electronics

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Customer Deliverables

Spectral Gamma Ray	Resistivity	Neutron	Density	PEF	Ultrasonic Imager/Caliper	Vibration
Apparent GR Corrected GR Azimuthal GR Spectral GR Environmental Corrections	2Mhz shallow & deep phase and amplitude resistivity 400kHz shallow & deep phase and amplitude resistivity Borehole Corrections Distance to Boundary	Near/Far detector count rates Near/Far detector ratio Apparent neutron porosity Corrected neutron porosity Environmental Corrections	Near & Far detector count rates Apparent Near detector density Apparent Far detector density Corrected Density Density Correction Azimuthal Density Azimuthal Density corrections	Azimuthal Near detector PEF Azimuthal Far detector PEF Near Detector PEF Far Detector PEF	Mud slowness derived from mud cell transducer Average Standoff Average Borehole Diameter Azimuthal Standoff Azimuthal Borehole Calliper Azimuthal Ultrasonic Amplitude Formation Image	Lateral & Axial RMS Vibration Lateral & Axial Shock Rate Later & Axial Peak Shock RPM High-Resolution Shock and RPM Data
Memory download time for 7 days of storage <60 mins, <30 mins logging data						

GENERAL LWD TOOL SPECIFICATIONS

Imperial Oilfield Units / SI Units				
Tool OD	4 3/4"	4 3/4"	6 3/4"	6 3/4"
Maximum Tool OD	5 1/4"	133 mm	7 1/4"	184 mm
Hole Sizes (using diff. stabs)	6" 6 3/4"	152.4–171.45 mm	8 1/2"–9 7/8"	215.9–250.83 mm
Maximum Flow Rate	400 gpm	1,514 lpm	800 gpm	3,028 lpm
Maximum Weight on Bit	35,000 lbf	155,687 N	55,000 lbf	244,652 N
Maximum Drilling Torque	8,500 lbf-ft	11,524 Nm	25,000 lbf-ft	33,896 Nm
Connections	NC38 Box-Box		NC50 Box-Box	
Dogleg Severity - Sliding	30˚/100 ft	30˚/30 m	16˚/100 ft	16˚/30 m
Dogleg Severity-Rotating	15˚/100 ft	15˚/30 m	8˚/100 ft	8˚/30 m
Operating Temperature	-4 to 347˚F -20 to 175˚C			
Maximum Pressure	20,000 psi 137.9 MPa			

Spectral Azimuthal Gamma Ray Measurement

Spectral Azimuthal Gamma Ray Sensor Specifications			
GR Sensor Package	Large NaI Scintillation	**Number of Detectors**	One
Total GR Range	0–1000 API	**Measurement Point to Bottom**	1.75 ft (0.53 m)
Total GR Accuracy	± 2 API	**Repeatability**	GR: ± 3 API @ 1000 API @ 180 ft/hr (54.9 m/hr), 6 in samples K: ± 2% @ 18 0ft/hr (54.9 m/hr), 6 in samples U: ± 5% @ 180 ft/hr (54.9 m/hr), 6 in samples T: ± 10% @ 180 ft/hr (54.9 m/hr), 6 in samples
Potassium Range	0–20%		
Potassium Accuracy	± 2%		
Uranium Range	0–500 ppm		
Uranium Accuracy	± 2%		
Thorium Range	0–500 ppm		
Thorium Accuracy	± 2%	**Image Sectors**	32 Sectors recorded 16 Sector compressed real time
Vertical Resolution	8 in (203.3 mm)		

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Propagation Resistivity Measurement

Propagation Resistivity Sensor Specifications				
Measurement Point to the Bottom	12.9 ft		3.93 m	
Frequency	2 MHz Phase Shift	2 MHz Attenuation	400 kHz Phase Shift	400 kHz Attenuation
Range (ohm-m)	0.1–4000	0.1–200	0.1–4000	0.1–100
Accuracy	± 0.02 ohm-m (0.1 – 25 ohm-m)	± 1.5% (0.1 – 25 ohm-m)	± 0.02 ohm-m (0.1 – 25 ohm-m)	± 3% (0.1 – 10 ohm-m)
	0.3 mmho/m above 25 ohm-m	0.75 mmho/m above 25 ohm-m	± 0.3 mmho/m above 25 ohm-m	± 4 mmho/m above 10 ohm-m
Vertical Resolution	8–12 in	203–305 mm	8–12 in	203–305 mm

Neutron Porosity Measurement

Neutron Porosity Sensor Specifications			
Sensor	Porosity		
Sensor Type	He3 Tubes		
Units	Imperial Oilfield	SI	
Measurement Point to Bottom	17.7 ft	5.39 m	
Range	-4 to 100 p.u.		
Accuracy	± 0.5 p.u.		
Vertical Resolution	16 in	406.4 mm	
Statistical Repeatability	± 0.5 p.u. under 10 p.u, 5% 10-40 p.u at 180 ft/hr (54.9 m/hr), 6 in samples		
RA Source	Am241/Be source	**RA Source Wireline Retrievable**	No

Caliper-and Toolface-Corrected Azimuthal Formation

Caliper-and Toolface-Corrected Azimuthal Density / Photoelectric Effect				
Sensor	Density		Photoelectric Effect (Pe)	
Sensor Type	PMT Scintillation Detectors, one near and one far detector			
Units	Imperial Oilfield	SI	Imperial Oilfield	SI
Measurement Point to Bottom	6.1 ft	1.9 m	6.1 ft	1.9 m
Measuring Range	1.5–3.1 g/cc		1–10 B/e	
Accuracy	± 0.015 g/cc (1.7–3.0 g/cc)		± 0.15 B/e	
Statistical Repeatability	± 0.01 g/cc at 2.2 g/cc at 180 ft/hr (54.9 m/hr), 6 in samples		± 0.25 B/e at 3 B/e at 180 ft/hr (54.9 m/hr), 6 in samples	
Total Error	± 0.02 g/cc at 2.2 g/cc at 180 ft/hr (54.9 m/hr), 6 in samples		± 0.35 B/e at 3 B/e at 180 ft/hr (54.9 m/hr), 6 in samples	
Vertical Resolution	6–16 in (152.4–406.4 mm)			
Image Sectors	32 sectors recoded: azimuthal density, azimuthal density correction, azimuthal near detector PEF, azimuthal far detector PEF			
	16 sectors compressed real time azimuthal density, azimuthal density correction, azimuthal near detector PEF, azimuthal far detector PEF			
RA Source	Cs137, 1.5 Curie			
	Gain Stabilization using low activity Cs137 seed sources			

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Caliper / Ultrasonic Imager Measurement

Caliper / Ultrasonic Imager Sensor Specifications		
Sensor Type	Ultrasonic	
Units	Imperial Oilfield	SI
Measurement Point to Bottom	8.8 feet	2.68 m
Measurement Range	0.5 – 2.5 in	12.7 – 63.5 mm
Vertical Resoultion	0.5 ins	152 mm
Max Mud Weight	14 ppg OBM/WBM	
Max Mud Slowness	300 us/ft	
Total Error	Caliper: ± 0.075 in @ 1" standoff	
Image Sectors	128 sectors recorded caliper and formation image	
	16 sectors compressed real time caliper and formation image	

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