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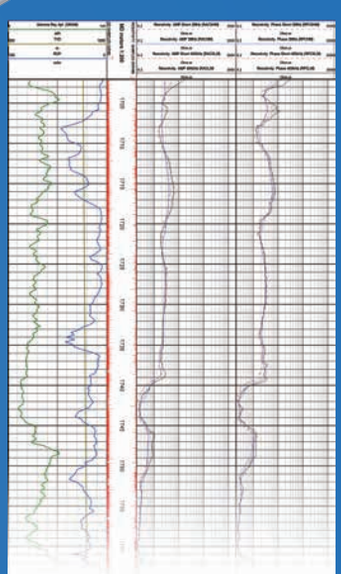
Hostile Logging While Drilling System (HostileLWD)

Bi-directional Communication Power Module-Hostile (BCP-H)

Pressure & Caliper Measurement While Drilling (PCD)

Electromagnetic Propagation Resistivity-B (EPR-B)

Wireless Measurement While Drilling-B (MWD-B)



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Hostile Logging While Drilling System (HostileLWD)

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Applications

- Well trajectory monitoring
- Provides Resistivity and Azimuthal Gamma
- Provides Borehole Pressure and Caliper

Features

- Inclination near to bit
- Bi-directional Communication
- Connect to Rotary Steerable Unit (RSU) optional
- Long working time without replacing battery under generator mode
- Rotary pulser is suitable to various muds and works under high LCM conditions

Introduction

HostileLWD is designed for hostile environment such as high temperature, high pressure, high LCM mud, and well measurement depth (MD) is more than 5000 meters. The maximum temperature is 175°C and maximum pressure is 25000 psi. Rotary pulse generator is able to work under hostile mud environment.

Components

Bi-directional Communication Power Module-Hostile (BCP-H)
Pressure & Caliper Measurement While Drilling (PCD)
Electromagnetic Propagation Resistivity-B (EPR-B)
Wireless Measurement While Drilling-B (MWD-B)

Note: MWD-B includes Azimuthal Gamma Ray. PCD is optional.

Specifications

General Tool Specifications			
Tool O.D. (Nominal)		4.75 in.	6.75 in.
Hole Size		5-3/4 in. to 6-3/4 in. (146-172 mm)	8-3/8 in. to 10-5/8 in. (212-270 mm)
Connections		3-1/2 in. IF box up and 3-1/2 in. I.F. pin down	4-1/2 in. I.F. box up and 4-1/2 in. I.F. pin down
Dogleg Severity	Max Rotating	10°/100 ft. (10°/30 m)	13°/100 ft. (13°/30 m)
	Max Sliding	30°/100 ft. (30°/30 m)	20°/100 ft. (20°/30 m)
Mud Flow Range		125-350 gpm	200-900 gpm

Operating Specifications	
Maximum Temperature	350°F (175 °C)
Maximum Pressure	25000 psi (172.4 MPa)
Sand Content	Maximum volume recommended<1%
Lost Circulation Material	Fine to medium nut plug
Pulsation Dampener	Recommended set to 1/3 stand pipe pressure
Data Acquisition	Mud pulse telemetry to surface and downhole memory
Telemetry Type	Positive pulse
Mud Pumps	Either duplex or triplex
Downhole RPM	± 80% maximum deviation from the mean Operating rpm (e.g., 100 rpm: Operation Range=20-180 rpm)
Pulser Pressure Drop	Pressure drop dependent upon mud weight, flow rate, MWD tool valve gap, and data transmission rate.
DP at Bit	No restrictions
Mud Filter (Uphole)	Most sizes supplied
Full Survey Transmission	55 seconds from Pumps-On

Bi-directional Communication Power Module-Hostile (BCP-H)

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Applications

- Transmission of downhole data to surface
- Transmission of surface commands to downhole

Features

- Long working time without replacing battery under generator mode
- Rotary pulser is suitable to various muds and works under high LCM conditions

Introduction

Bi-directional Communication Power Module-Hostile (BCP-H) and downlink devices (BPC, NPG).

The BCP-H (Bi-directional Communication & Power Module-Hostile) is capable of generating 300 Watt power output, providing 33 Vdc to the InteLWD system, providing circuit breaker protection for upper and lower mounted instruments, detecting downlink data by monitoring turbine speed, ptransmitting data to the surface via a pulser. It can be installed in any position of the instrument string, which provides a lot of conveniences for the logging.

The BPC (Bypass Controller) sends commands from the surface to downhole instrument by controlling the NPG (Negative Pulse Generator) which controls the mud flow.

Specifications

Tool O.D.	4.75 in.	6.75 in.
Make-up Length	14.11 ft. (4.3 m)	10.70 ft. (3.2 m)
Weight	903 lbs. (410 kg)	1,249 lbs. (565 kg)
Flow Range	125-350 gpm	200-900 gpm
Max Temperature	350°F (175°C)	
Max Pressure	25000psi (172.4 MPa)	
Max Turbine RPM	5000	
Output	33 Vdc±1	
Max Power output	300 Watts	

BCP-H

Pressure & Caliper Measurement While Drilling (PCD)

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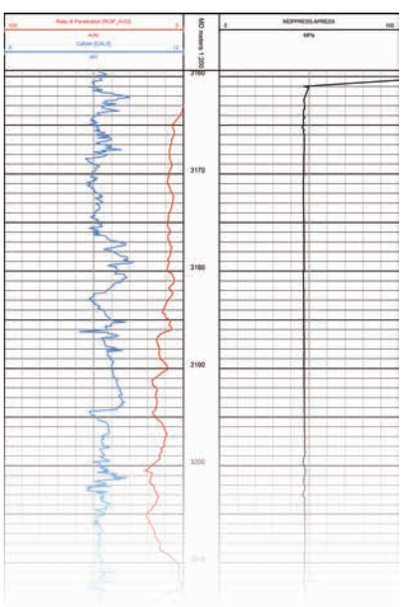
Features

- Accurate downhole measurement of equivalent circulating density.
- Swab/surge pressure monitoring while tripping and reaming.
- Accurate downhole measurement of hydrostatic pressure and effective mud weight.
- Accurate measurement of caliper by ultrasonic.



Introduction

PCD can accurately detect the annular pressure, the caliper, the borehole pressure and temperature. It is used to judge the underground complex situation, such as well leakage, blowout, well inflow and monitoring well, and conductive to the control of well safety.

Specifications

Tool O.D.	4.75 in.	6.75 in.
Max Pressure	20,000 psi (137.9 MPa)	
Maximum Temperature	300°F (150°C)	
Make-up Length	6 ft.-2.8 in. (1.9 m)	
Operating Time	Real-time/ No limited	
Data Acquisition Type	Real-time & Downhole Record	
Pressure Measurement Range	0-25000 psi	
Caliper Measurement Range	5.30 to 7.30 in. (135 to 185 mm)	7.30 to 9.30 in. (185 to 236 mm)
Caliper Accuracy	±0.2 in. (± 5 mm)	

Electromagnetic Propagation Resistivity-B (EPR-B)

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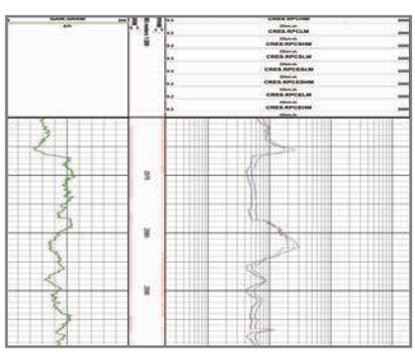
Applications

- Provides formation resistivities
- Provide realtime formation evaluation services.
- Provide wellbore placement
- Improve geosteering capabilities
- Operates at frequency of 2 MHz and 400 kHz Compensated antenna design with dual spacing transmitter pairs.

Features

- 8 quantitative resistivities with separate depths of investigation works in all mud types.
- Adopt insert mode, different size (4.75 in. /6.75 in.) instrument can share insert probe, reduce the cost.



Introduction

EPR-B transmits electromagnetic waves into the formation and measures the changes in the physical characteristics of the returned electromagnetic waves. The changes in the physical characteristics of the electromagnetic waves indicate the formation resistivity.

Specifications

Tool O.D.		4.75 in. / 6.75 in.	
Max Operating Temp		350°F (175°C)	
Max Working Pressure		25000 Psi (172.4 MPa)	
2 MHz	Phase Difference	Range	0.1-3000 ohm-m
		Accuracy	± 1% (0.1-50 ohm-m); ±0.5 mmho/m (> 50 ohm-m)
	Attenuation	Range	0.1-500 ohm-m
		Accuracy	± 2% (0.1-25 ohm-m); ±1.0 mmho/m (> 25 ohm-m)
		Vertical Resolution	8 in. (203 mm)
400 kHz	Phase Difference	Range	0.1-1000 ohm-m
		Accuracy	± 1.0% (0.1-25 ohm-m); ±1.0mmho/m (>25 ohm-m)
	Attenuation	Range	0.1-200 ohm-m
		Accuracy	± 5.0% (0.1-10 ohm-m); ±5.0mmho/m (>10 ohm-m)
		Vertical Resolution	12 in. (304 mm)

Wireless Measurement While Drilling-B (MWD-B)

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Applications

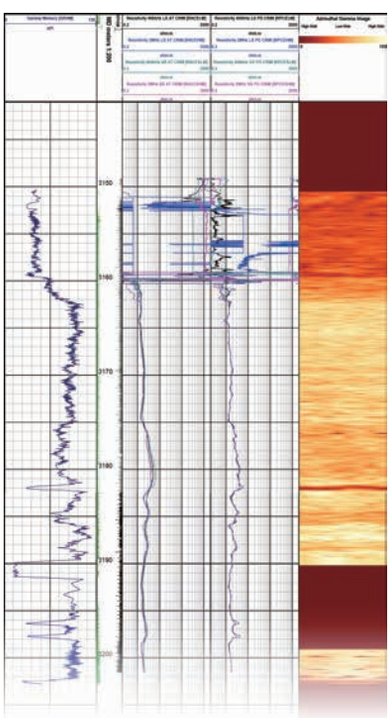
- Steering drilling systems for re-entry and horizontal wells.
- Directional control
- Relief well drilling
- Precision geosteering in high angle wells.

Benefits

- Automated directional control
- Improved horizontal TVD control
- Reduced hole tortuousity
- Azimuthal kick off mode

Features

- Adopt insert mode, different size (4.75 in./6.75 in.) instrument can share circuit, reduce the cost.
- Azimuthal gamma ray confirmation formation boundaries and orientation, guides directional drilling operations better



Specifications

Measurement	Range	Resolution	Accuracy
Inclination	0°-180°	0.1	± 0.15°
Azimuth	0°-360°	0.35	±1.0 @ INC>10°
Toolface	0°-360°	1.4	± 1.5°
Magnetic	0°-360°	1.4	± 1.5°
Gravity	0°-360°	1.4	± 1.5°
Temperature	10°C-150°C, 175°C optional	1.1	± 3.0°C
Total Magnetic Field	30,000-66,000 gamma	100	± 300
Transmission Rates	0.4 bit/s～2 bits/s Pulse Width Selectable: 3.0/2.0/1.5/1.0/0.8/0.5/0.36/0.32/0.24 sec		
Directional Probe OD	1.75 in.		
Max Temperature	350°F (175°C)		
Max Pressure	25000 Psi (172.4 MPa)		
MTF/GTF Switching, Inclination Degrees: MTF/GTF Switching, Operator Selectable (default set at 3°) Inclination Degrees			

Vibration Measurement		
Sensor Type	Axial Vibration	One Accelerometer, Z direction
	Lateral Vibration	Two Accelerometers, X-Y direction
Acceleration Range		0-15 g
Frequency Range		0-82 Hz
Realtime Log Options		Lateral and Axial vibration; Transmitted as severity level (scaled to g-RMS)
Post Run/Memory Log Options		Average & Max. lateral and axial vibration in g-RMS and as severity level

Rotation & Stick-Slip Measurement	
Sensor Type	Two Axis Magnetometer
Rotation Speed	0-±1000 RPM
Accuracy	±1%
Realtime Log Options	Downhole RPM, Stick-Slip transmitted as severity level
Post Run/Memory Log Options	Min., Max., & Average RPM, Stick-Slip & Backward Rotation severity

Azimuthal Gamma Ray Specifications	
Sensor Type	Scintillation
Measurement	API GR
Real Time	Yes
Recorded	Yes
Range	0-500 API
Section Quantity	8
Accuracy	±3% of full scale
Statistical Repeatability	±3 API @ 100 API and ROP = 60 ft./hr
Vertical Resolution	6 in.

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