Weatherford®

HEL™ MWD System

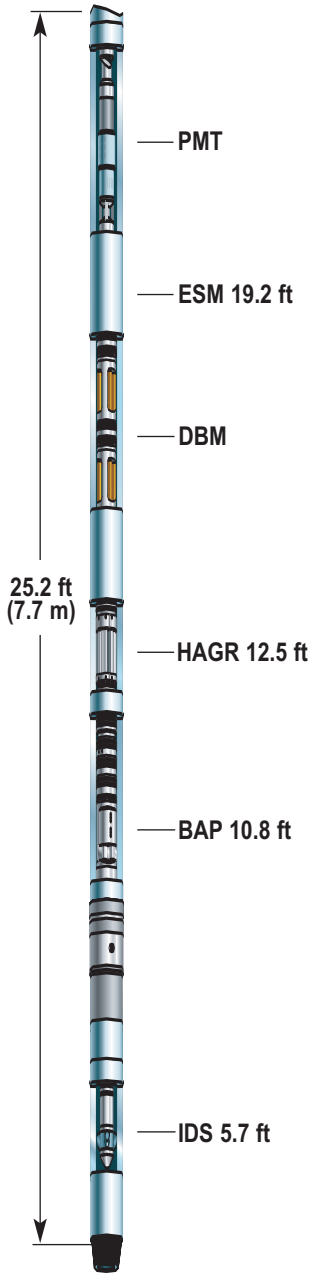
The hostile-environment logging (*HEL*) MWD system is specifically designed for today's high-pressure/high-temperature hostile drilling environments. Designed to operate at temperatures up to 356°F (180°C) and to withstand downhole pressures up to 30,000 psi (207 MPa), the *HEL* MWD system meets or exceeds all existing MWD system specifications.

Applications

- The *HEL* MWD system is qualified using the most stringent testing regime in the industry. Tests include flow-loop erosion, lost circulation, high-pressure tests at elevated temperatures, and aggressive vibration qualification including innovative random-on-random standards during multiple temperature cycles.

Features, Advantages and Benefits

- Rated up to 30,000 psi (207 MPa) operating pressure, depending on tool size.
- Reliable operation at temperatures up to 356°F (180°C).
- High flow rates for all size tools: 4 3/4 in. (400 gal/min), 6 3/4 in., 8 in. (800 gal/min), 8 1/4 in. and 9 1/2 in. (1800 gal/min).
- System handles lost circulation material (LCM) up to 80 lb/bbl.
- Pressure Modulated Telemetry (PMT™) system uses mudflow and battery power to generate a positive mud pulse.
- Environmental Severity Measurement (ESM™) sensor monitors tool shock and drilling vibration.
- Dual Battery Module (DBM™) assembly provides long-duration, redundant power for extended downhole operation.
- High-Temperature Azimuthal Gamma Ray (HAGR™) tool for accurate API gamma ray measurements.
- Bore/Annular Pressure (BAP™) sensor uses quartz transducers to provide highly accurate bore and annular pressure measurements.
- Integrated Directional Sonde (IDS™) provides directional and toolface measurements.



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HEL™ MWD System

Specifications

Mechanical Specifications					
Nominal Sensor OD	**4 3/4 in.**	**6 3/4 in.**	**8 in.**	**8 1/4 in.**	**9 1/2 in.**
Maximum OD	5 1/4 in.	7 3/8 in.	8 5/8 in.	8 7/8 in.	9 1/2 in.
Length (HEL system)	25.2 ft	25.3 ft	25.2 ft	25.6 ft	25.8 ft
Weight	1400 lb	2850 lb	4100 lb	4000 lb	5500 lb
Top connection	3 1/2 IF box	4 1/2 IF box	6 5/8 Reg box	5 1/2 IF box	7 5/8 Reg box
Bottom connection	3 1/2 IF pin	4 1/2 IF pin	6 5/8 Reg pin	5 1/2 IF pin	7 5/8 Reg pin
Make-up torque	9900–10,900 ft-lb	28,000–32,000 ft-lb	52,000–56,000 ft-lb	53,000–56,000 ft-lb	75,000–78,000 ft-lb
Maximum torque	16,700 ft-lb	44,700 ft-lb	77,300 ft-lb	80,100 ft-lb	112,000 ft-lb
Maximum tension	528,000 lb	978,000 lb	1,480,000 lb	1,450,000 lb	1,870,000 lb
Bending strength ratio	2:10	2:53	2:70	2:47	3:10
Maximum dogleg severity, rotating	20°/100 ft	11°/100 ft	10°/100 ft	9°/100 ft	8°/100 ft
Maximum dogleg severity, sliding	36°/100 ft	19°/100 ft	16°/100 ft	15°/100 ft	14°/100 ft
Equivalent bending stiffness (OD x ID)	4.75 in. x 3.22 in.	6.75 in. x 4.20 in.	8.0 in. x 4.18 in.	8.25 in. x 5.17 in.	9.5 in. x 5.16 in.
Maximum operating temperature	356°F (180°C)	356°F (180°C)	356°F (180°C)	356°F (180°C)	356°F (180°C)
Maximum operating pressure	30,000 psi (207 MPa)	30,000 psi (207 MPa)	30,000 psi (207 MPa)	25,000 psi (172 MPa)	25,000 psi (172 MPa)
Maximum flow rate	400 gal/min	800 gal/min	800 gal/min	1800 gal/min	1800 gal/min
Maximum sand content	2%	2%	2%	2%	2%

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HEL™ MWD System

Specifications

Sensor Specifications					
Nominal Sensor OD	**4 3/4 in.**	**6 3/4 in.**	**8 in.**	**8 1/4 in.**	**9 1/2 in.**
BAP™ Sensor					
Transducer type	Quartz crystal	Quartz crystal	Quartz crystal	Quartz crystal	Quartz crystal
Resolution	1 psi	1 psi	1 psi	1 psi	1 psi
Accuracy	± 7.5 psi	± 7.5 psi	± 7.5 psi	± 7.5 psi	± 7.5 psi
Repeatability	± 3 psi	± 3 psi	± 3 psi	± 3 psi	± 3 psi
Measurement range	0–30,000 psi	0–30,000 psi	0–30,000 psi	0–25,000 psi	0–25,000 psi
Measure point from bottom of sensor	10.6 ft	10.6 ft	10.6 ft	10.6 ft	10.6 ft
HAGR™ Sensor Specifications					
Measurement range	0–250 API	0–250 API	0–250 API	0–250 API	0–250 API
Accuracy	± 2 API	± 2 API	± 2 API	± 2 API	± 2 API
Vertical resolution	18 in.	18 in.	18 in.	18 in.	18 in.
Statistical repeatability	± 5 API @ 100 ft/hr	± 5 API @ 100 ft/hr	± 5 API @ 100 ft/hr	± 5 API @ 100 ft/hr	± 5 API @ 100 ft/hr
Measure point from bottom of sensor	12.5 ft	12.3 ft	12.4 ft	12.4 ft	12.4 ft
IDS™ Sensor Specifications					
Sensor face update period	3 sec	3 sec	3 sec	3 sec	3 sec
Sensor face accuracy	± 1.5°	± 1.5°	± 1.5°	± 1.5°	± 1.5°
Inclination accuracy	± 0.1°	± 0.1°	± 0.1°	± 0.1°	± 0.1°
Azimuth accuracy	± 0.5°	± 0.5°	± 0.5°	± 0.5°	± 0.5°
Survey update	30 sec	30 sec	30 sec	30 sec	30 sec
Measure point from bottom of sensor	5.7 ft	5.3 ft	5.6 ft	5.6 ft	5.6 ft
ESM™ Sensor Type - All Sizes					
Single-axis (x) accelerometer	Peak G 0–200 Gs RMS G 0–100 Gs		Avg.>30 Gs 30–200 Gs Shocks/sec. 0–255		

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