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Dual-Packer Module

Inflatable packers that seal against the borehole wall to isolate the interval for MDT tester operations

APPLICATIONS

Used with the MDT* modular formation dynamics tester for

- Downhole fluid analysis (DFA)
- Formation fluid sampling
- Formation pressure measurement and fluid gradient estimation
- Determination of pretest drawdown mobility (permeability/viscosity)
- Permeability and anisotropy determination away from the well
- In situ stress determination

High-performance packers

The Dual-Packer Module (MRPA) of the MDT modular formation dynamics tester consists of two inflatable packer elements that seal against the borehole wall to isolate an interval, improving the effectiveness of pressure measurement and fluid sampling in low-permeability, laminated, or fractured formations.

High-performance packers are run with the MRPA to expand the MDT tester's operating envelope, with a temperature rating to 410 degF [210 degC] and compatibility with both water- and oil-base mud systems. The superior elasticity and improved durability of the high-performance packers enable performing more stations per run and lessen packer replacement. The asymmetrical packer design reduces sticking and bulging potential.

Operational reliability is further enhanced by the autoretract mechanism (ARM), which applies a longitudinal tensile force to assist in retracting the packers after deflation, in turn minimizing drag. At temperatures below 225 degF [107 degC], the elements retain enough elasticity for operation without the ARM.

The MDT Pumpout Module (MRPO) is used to inflate the packers with fluid.

Reliability in high-H_2S environments

For operations in H_2S environments, the Dual-Packer Module is available in a NACE-compliant version for sampling up to 50% H_2S in hole sizes from 5⅞ to 9⅝ in.

Effective isolation of large areas

The length of the test interval between the packers is 3.2 ft [0.98 m] and can be extended to 5.2, 8.2, or 11.2 ft [1.58, 2.5, or 3.41 m] by using 2- and 3-ft [0.61- and 0.91-m] spacers with large-diameter mandrels. For the 3.2-ft interval, the area of the isolated interval of the borehole is about 3,000 times larger than the area of the borehole wall isolated by the MDT tester's Single-Probe Module (MRPS). For fluid sampling, the large area results in flowing pressures that are only slightly below the reservoir pressure, which avoids phase separation even for pressure-sensitive fluids such as gas condensates or volatile oils. In low-permeability formations, high drawdown usually occurs with the probe, whereas fluid can be withdrawn from the formation using the MRPA with minimum pressure drop through the larger flowing area. In finely laminated formations, the MRPA can be used to straddle permeable streaks that would be difficult to locate with a probe. In fractured formations, the MRPA can usually seal the interval whereas a probe could not.

Dual-Packer Module.

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For pressure transient testing, following a large-volume flow from the formation, the resulting pressure buildup has a radius of investigation of 50 to 80 ft [15 to 24 m]. Depending on the application, an interval pressure transient test (IPTT) provides advantages over a conventional drillstem test (DST). It is environmentally friendly because no fluids flow to the surface, and it is cost effective because many zones can be tested in a short time.

The MRPA can be used to create a micro-hydraulic fracture that can be pressure tested to determine the minimum in situ stress magnitude. The fracture is created by pumping wellbore fluid into the interval between the inflatable packer elements.

Measurement Specifications

	MRPA
Range of measurement	CQG* crystal quartz gauge: 750 to 15,000 psi [5 to 103 MPa]
	Quartzdyne® gauge: 0 to 25,000 psi [0 to 172 MPa]
	Axton* dynamically compensated single quartz gauge: 0 to 30,000 psi [207 MPa] to 374 degF [190 degC] and 0 to 20,000 psi [138 MPa] to 392 degF [200 degC]†
	Temperature: –67 to 400 degF [–55 to 204 degC]
Resolution	CQG gauge: 0.008 psi [55 Pa] at 1.3-s gate time
	Quartzdyne gauge: 0.01 psi/s [69 Pa/s]
	Axton gauge: 0.008-psi [55-Pa] rms at 1-s gate time
	Temperature: 0.01 degF [0.05 degC]
Accuracy	CQG gauge: ±(2 psi [13,789 Pa] + 0.01% of reading)‡
	Quartzdyne gauge: ±(0.02% of full scale + 0.01% of reading)
	Axton gauge: ±2.0 psi [±13,689 Pa] for typical HPHT operational range (>212 degF [>100 degC] and >15,000 psi [>103 MPa]) and ±6.0 psi [±41,368 Pa] for full range‡
	Temperature: ±1.0 degF [±0.5 degC]

† Operating range up to 400 degF and default calibration to 392 degF with calibration to higher temperature on requries.

‡ Includes fitting error, hysteresis, repeatability, and allowance for sensor aging; the corresponding percentages of the pressure reading account for the incertitude of the calibration equipment.

Dual-Packer Module Packers Mechanical Specifications

Packer	Outside Diameter, in [cm]	Hole Size—Min., in	Hole Size—Max., in	Temperature Rating, degF [degC]	Pressure Rating, psi [MPa]	Differential Pressure Rating, psi [MPa]	Type	Recommended Number of Settings†
SIP-A3-5in	5 [12.70]	5.875	7.5	350 [177]	20,000 [138]	4,500 [31]	Symmetrical	10 settings at 3,000 psi in 6-in hole
SIP-A3A-5in	5 [12.70]	5.875	7.5	350 [177]	20,000 [138]	4,500 [31]	Asymmetrical	10 settings at 3,000 psi in 6-in hole
IPCF-H2S-500	5 [12.70]	5.875	7.5	350 [177]	20,000 [138]	TBQ‡	Asymmetrical	TBQ‡
SIP-A3-6.75in	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	3,000 [21]	Symmetrical	10 settings at 3,000 psi in 8.75-in hole
SIP-A3A-6.75in	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	3,000 [21]	Asymmetrical	10 settings at 3,000 psi in 8.75-in hole
IPCF-PAS-700	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	3,000 [21]	Symmetrical	10 settings at 3,000 psi in 8.5-in hole
IPCF-PA-700	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	3,000 [21]	Asymmetrical	10 settings at 3,000 psi in 8.5-in hole
IPCF-PC-700	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	4,500 [31]	Asymmetrical	5 settings at 4,500 psi in 8.5-in hole
IPCF-BA-700	7 [17.78]	7.875	9.625	410 [210]	20,000 [138]	3,000 [21]	Asymmetrical	3 settings at 3,000 psi in 8.5-in hole
IPCF-H2S-700	7 [17.78]	7.875	9.625	350 [177]	20,000 [138]	3,000 [21]	Asymmetrical	10 settings at 3,000 psi in 8.5-in hole
SIP-A3A-8.5in	8.5 [21.59]	9.875	14	350 [177]	20,000 [138]	3,000 [21]	Asymmetrical	10 settings at 3,000 psi in 12.25-in hole
SIP-A3A-10in	10 [25.40]	11	17.5	350 [177]	20,000 [138]	2,100 [14]	Asymmetrical	7 settings at 2,100 psi in 14.4-in hole

† At the specified pressure and hole size

‡ To be qualified

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