

RCX MAGNA large area multi-probe sampling service

Safe and efficient sampling in ultra-low mobility formations

In the exploration of ultra-low mobility wells, you are reluctant to deploy inflatable packers due to high risks and adverse effects on operational efficiency. Inflatable packers are prone to differential sticking and become deformed after multiple settings, causing well swabbing when pulling out of hole.

The **RCX™ MAGNA large area multi-probe sampling service** is the industry's largest probe packer that can test and sample in ultra-low mobility reservoirs with 66 square inches of flow area and differential limits of up to 7,500 psi. The robust downhole pressure testing and sampling tool is designed with two large flow-area probes positioned radially, 180 degrees from each other at the same depth.

Improve efficiency in ultra-low mobility reservoirs

Low permeability formations require a large flow area to limit the effect of high-pressure differentials on sample efficiency. The RCX MAGNA service provides testing and sampling to 0.1 md/cp to acquire accurate and reliable data.

Reduce risk and eliminate reliance on inflatable packers

The multi-probe module provides risk-free deployment and includes an equalization feature to eliminate differential sticking. The RCX MAGNA service offers unlimited settings and is not impacted by hole ovality. The large flow area provides safer, efficient and reliable testing and sampling in ultra-low mobility reservoirs without the need for inflatable packers.

Save time with increased flexibility and remote support

Modularity in the design of the RCX MAGNA service allows custom configurations with all products available in the wireline formation evaluation portfolio and enables the ability to achieve all well sampling and testing objectives in a single descent.

The RCX MAGNA services is also fully enabled for **Sabio™ Log from Anywhere services**. This combination provides full testing and sampling control remotely-offering complete job capabilities while reducing the number of personnel required at the well site.

Applications

- Low permeability reservoirs
- Unconsolidated formations
- Laminated and heterogeneous formations
- Heavy oil sampling
- Challenging boreholes

Features and benefits

- Large flow area improves efficiency while testing and sampling in ultra-low mobility reservoirs to 0.1 md/cp
- Multi-probe module provides risk free deployment and eliminates dependency on inflatable packers
- Compatibility and flexibility with entire product portfolio saves time and achieves all objectives in a single descent

Contact your Baker Hughes representative to learn more about how RCX MAGNA large area multi-probe sampling service can mitigate risk and improve the performance of your well. Safe and efficient sampling in ultra-low mobility reservoirs without the dependency on inflatable packers.



Measurement Specifications

Conveyance method	Wireline or pipe conveyed
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Range of measurement

Pressure	0 to 25,000 psi
Sample mobility	0.1 md/cp and above

Temperature rating	375°F (190.56°C)
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Pressure rating	25,000 psi (172.37 MPa)
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Borehole size	5.875-in. to 14-in.
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Borehole ovality	Not impacted
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Outsite diameter	4.75-in. (tool body OD)
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Total probe flow area	66-in. ² (425.81 cm ²)
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Pretest volume	1 cc to unlimited
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Drawdown rate	0.1 to 11 cc/s
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Pressure differential	7,500 psi (51.71 MPa)
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Case study: Middle East

RCX MAGNA large area multi-probe service achieved all objectives in an extremely challenging borehole

While operating in the Middle East a customer drilled an 8³/₈-in. well with water-based mud. Open-hole logs identified the well had high rugosity and washouts. The estimated maximum overbalance across the reservoir was 5,500 psi with expected mobility as low as 0.1 to 1.0 md/cp, making the deployment and retrieval a major concern. Achieving a seal within a borehole in this condition would also be difficult. Pipe conveyed logs were required to retrieve the sampling and testing tool string after deployment because of differential sticking risks over multiple overbalanced reservoirs.

To evaluate the commercial value, make important decisions about optimum recovery strategies, and maximize the return on investment, the customer required exceptional service performance to collect pressure data, fluid characterization, and representative samples. The customer needed to efficiently secure samples in the ultra-low mobility reservoir with contamination less than 5% and successfully retrieve the tool string out of the well. Other vendors could only perform the job using inflatable packers. The customer wanted to avoid the use of inflatable packers due to the high risk of becoming stuck downhole and additional time for clean out.

Due to the extreme wellbore conditions and high risk of differential sticking, the Baker Hughes Wireline team recommended the **RCX™ MAGNA large area multi-probe sampling service**. The RCX MAGNA service is the industry's largest probe packer

that can test and sample in ultra-low mobility reservoirs as low as 0.1 md/cp with 66 square inches of flow area and differential limits of up to 7,500 psi. The RCX MAGNA service includes an equalization feature that prevents differential sticking and reduces the dependency on inflatable packers.

The RCX MAGNA large area multi-probe sampling service provided the modularity that allowed the customer to design a custom tool string to achieve all objectives in a single decent. A single probe, straddle packer, and the RCX MAGNA service were included in the same testing and sampling string to facilitate decision-making during the job. The straddle packer was included as a contingency and the operation of the inflatable packer was not required during the job.

Baker Hughes achieved impressive results in an extremely challenging borehole. The high differential limits and large flow area of the RCX MAGNA service resulted in high flow rates with less pressure drop for efficient operation. The RCX MAGNA service eliminated the need of inflatable packers and secured the samples at all stations in less time. The job challenged the capabilities of the RCX MAGNA service with the lowest mobility sampled of 0.14 md/cp with an overbalance of 5,500 psi. The equalization feature allowed the customer to increase the time on stations for pumping out borehole fluid while avoiding differential sticking. The total time on the wall during execution was approximately 28 hours.

Challenges

- Secure samples in an ultra-low mobility formation
- Reduce risk of differential sticking
- Overcome overbalance across sampling and testing intervals
- Deploy and retrieve tool string in borehole with high rugosity and washouts

Results

- Achieved sampling objectives as low as 0.14 md/cp
- Sampled in overbalance of 5500 psi
- Retrieved string without sticking or over-pulls
- Eliminated the need for inflatable packers
- Saved 12 hours of rig time

Over multiple settings there was no over pull coming off the wall and no sticking issues during retrieval, demonstrating the safe and risk free deployment.

The RCX MAGNA large area multi-probe sampling service saved the customer 12 hours of rig time and achieved all testing and sampling objectives. The customer was extremely pleased with the safe and efficient execution of the service.



RCX MAGNA large area multi-probe sampling service can test and sample in ultra-low mobility reservoirs as low as 0.1 md/cp with 66 square inches of flow area and differential limits of up to 7,500 psi.

MaxCOR Service

Enhanced Large Diameter sidewall coring technology

Applications

- Geochemistry
- Geomechanics
- Biostratigraphy
- Reservoir geology/petrology
- Routine and advanced rock properties
- Wireline log calibration
- Grain Size Analysis
- Source Rock & Hydrocarbon characterization

Features and benefits

- Retrieves up to 60 1.5-in. OD samples per run
 - Reliable service that saves valuable rig time.
- Uses a direct-drive electric motor for maximum power transfer
 - Consistently retrieves quality core samples with less coring time
- Operates up to 25,000 psi and 400°F (204°C)
 - High core-recovery efficiency even under hostile environments
- Monitors and controls the operation in real time through a graphical user interface
 - Provides reliable service with high core-recovery efficiency
- Acquires 225% more volume per unit length than standard 1" OD cores.
 - Large diameter core allows more accurate analysis

The **Baker Hughes MaxCOR™** service can recover 1-1/2 in. diameter cores, acquiring core that is 225% more volume per unit length compared to core recovered with standard rotary coring tools. This allows operators to more accurately evaluate reservoirs and maximize hydrocarbon recovery.

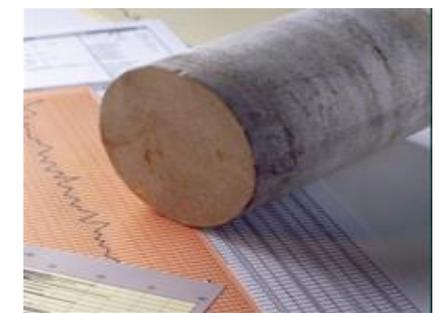
Large Diameter Cores

The accuracy of the measurement is directly proportional to the pore volume. Increasing the sample diameter from 1 to 1-1/2 in. more than doubles the pore volume per unit length and impacts the accuracy of a suite of core measurements that depend on pore volume (e.g., porosity, water saturation, capillary pressure, and SCAL measurements in general). In addition, 1-1/2 in. cores will allow much better geomechanical characterization of the rock, which in turn has significant implications to complete and produce complex reservoirs like gas shales.

Fast, Reliable & Efficient Core Recovery

- MaxCOR uses a direct-drive electric motor in place of a traditional hydraulic motor to power the bit.
- MaxCOR motor controlled by an advanced downhole power management system to ensure maximum power transfer efficiency under all load and borehole temperature conditions.
- The rotational speed of the bit is more than three times resulting in significant reduction of coring time.
- It achieves high core-recovery efficiency even under very hostile environments with pressures up to 25,000 psi and temperatures up to 400°F (204°C).

Specifications
Temperature: 400 °F (204.44 °C)
Pressure: 25,000 psi (172.37 MPa)
Core capacity: 60 cores
Core diameter: 1.5 in
Core length: 2.5 in
Borehole Size: 7.5 to 14 in
Outside Diameter: 6.25 in



Case study: North Sea, United Kingdom

MaxCOR Sidewall Coring Technology Performed Excellent Core Recovery in North Sea

Acquired 225% more volume per unit length than standard 1-in. OD cores

A Baker Hughes customer drilled a subvertical exploration well from a semisubmersible drilling rig in the northern part of the North Sea, targeting low permeability Jurassic sandstones. The area had previously seen poor recovery of sidewall cores, caused by high mud weights, substantial overbalances, low permeability sandstones, and low rates of penetration of conventional rotary sidewall coring tools. Downhole conditions included heavy high solids, nonaqueous-based mud (NABM), temperatures approaching 300°F (148.88°C) and pressures close to 11,500 psi (792.89 bar).

Baker Hughes deployed **MaxCOR™ sidewall coring** technology with a full suite of Deployment Risk Management™ (DRM™) technology including jars, flywheels, and high-strength wireline. All deployment issues were successfully mitigated.

Twenty-nine core points were specified, ranging from lower reservoir sands to Upper Jurassic siltstones, coal, and claystones. From these 29 points, the MaxCOR tool recovered 22 cores. Overbalance pressure at the core points was approximately 1,000 psi (68.94 bar). Sidewall cores were a cost-effective way to obtain diagenetic and porosity/permeability information.

The MaxCOR technology efficiently recovered high-quality, large-diameter sidewall cores from this challenging environment, while operational risk was reduced through

the application of Baker Hughes DRM practices.



Challenges

- Northern North Sea exploration well
- 290°F temperature and 11,500 psi pressure
- Heavy mud system with high percentage of solids (1.95SG/ and 35% solids)
- 1,000 psi overbalance
- 8½-in. openhole, 10° deviation

Results

- MaxCOR sidewall coring technology deployed on wireline
- No overpulls were recorded
- 22 cores were recovered
- Average coring time was 5 min, 44 sec

Benefits

- Retrieved up to 60 1½-in. outside diameter (OD) core samples per run
- Acquired 225% more volume per unit length than standard 1-in. outside diameter (OD) cores
- Large diameter core samples allowed for more accurate analysis
- High core-recovery efficiency even under hostile environment
- Used a direct-drive electric motor for maximum power transfer
- Consistently retrieved high-quality core samples in less time