

# Drilling and Completion Fluids

Qatar lab capabilities





Qatar Laboratory is a recently built facility in Ras Laffan Industrial City (RLIC), this laboratory was established in June 2021 in the campus where brine tanks, Barite and Bentonite silos and the chemicals warehouse are in place. This laboratory provides the technical and operational support services to our customers in Qatar. This document herewith provides detailed information of the capabilities of this lab that can be offered to the customer in terms of services, tests and specialized equipment's.

The Baker Hughes Drilling and Completion Fluids Qatar Country Operations Laboratory is one of the Technology Laboratories established to provide technical support to Baker Hughes Drilling and Completion Fluids Operations to the customers in Qatar and also to support the regional and country operations lab.

The Technology Laboratories are located at:

• KSA • Dubai, UAE • Houston, USA

The Qatar Laboratory is directed by the Drilling Fluids Technical Manager, who has access to technical support from regional as well as global technical

groups of both fluids as well as all other product lines of Baker Hughes. The laboratory provides technical support and assistance to Baker Hughes Drilling Fluids Operational personnel as well as to our customers in the Middle East. It also supports other regions if and when required. This support includes but is not limited to customized oil and water-based mud formulations, drilling fluid analyses, completion fluid analyses, meso-phase near well bore remediation tests and analysis and QA/QC checks of locally purchased products and the recertification of warehouse products. Full field mud testing is also undertaken, if requested by the operator or by Baker Hughes and can include hot rolling and static aging of the fluid samples.

This laboratory has direct contact with Baker Hughes Drilling Fluids Instrumental Analysis laboratories in Houston, where the laboratory personnel have access to the detailed analysis performed using specialty instruments available to a few laboratories around the world.



## Standard laboratory testing

The laboratory carry out pilot tests as well as provides direction in the development and application of the Baker Hughes water-based fluids systems like PEFORMAX™, MAX-BRIDGE™ or PYRO-DRILL™, oil-based fluids systems like DELTA-TEQ™ and Mesophase technology like MICRO-WASH™, MICRO-PRIME™ or MICRO-CURE™ E2 systems.

### **Test analyses performed:**

- Water-base mud checks
- Oil-based mud checks
- Particle size distribution
- Static rheology
- Static filtration control
- Mud formula proposals
- Enhancement of mud properties
- Development of Completion Fluid formulas
- Water analysis
- Well remediation/MICRO-WASH™ analysis
- MICRO-CURE™/MICRO-PRIME™ analysis
- Permeability Plugging Tests
- Relative comparisons of effectiveness of similar products/ Product Evaluations & QA/QC testing

### **Testing equipment:**

- Fann Model 35 V-G Meter
- OFITE Model 800 Viscometer

- Brookfield Viscometer
- Turbidity Meter
- Silverson Mixer
- Hamilton Beach® Mixer
- pH Meter
- Permeability Plugging Tester with LCM evaluation capability
- Equipment's to perform Standard API mud checks
- Hot Rolling Oven
- Static Aging Oven
- Dissolved Oxygen Meter
- GGT kit
- Centrifuge
- Temperature bath

### **Project requests**

Any project requests should be submitted to the laboratory with a complete detailed Technical Service Request (TSR) form. The TSR form should include as much information and background as possible regarding the project requested or the mud samples to be analyzed. This will help the laboratory team get a better understanding of which tests need to be performed and what results are expected.



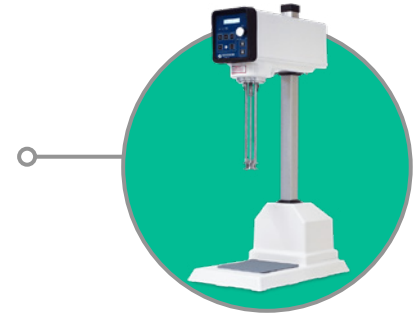
## Drilling Fluids equipment inventory

Equipment	Use
Dynamic Aging Ovens	Dynamic aging samples up to 482°F (250°C) Total capacity
Static Aging Ovens	Static aging samples up to 482°F (250°C)
Stainless Steel Pressurized Cells	Aging samples with pressure up to 482°F (250°C)
Stainless Steel Non-Pressurized Cells	Aging samples without pressure up to 302°F (150°C)
Silverson Mixers	High shear mixing devices for preparing fluids
OFI 50 mL Retorts	High temperature mud stills for determining water, oil solids content
Three Station Hamilton Beach® Mixers	Low shear mixers for fluid preparation. One with speed control to all three shafts.
Multimixer	Low shear mixer with 5 spindles
Top Loading Balance	Balances (600 to 0.01 grams) for weighting products mud testing
Six Speed Fann Viscometers and Heating Cups with Digital Temperature Controllers	Viscosity measurements
350 mL HTHP's/PPT Set	High temperature (392°F/200°C) high pressure (600 psi/4.13 MPa) filtrate units
Single Api Filtration Set	100 psi (0.68 MPa) differential pressure filtration unit
Automated HPHT Four Unit	High temperature (392°F/200°C) high pressure (600 psi/4.13 MPa) filtrate units
Four Station Api Filtration Unit Plus Cells	100 psi (0.68 MPa) differential pressure filtration unit
pH Meter	pH measurements
Electrical Stability Meter	ES measurements
Mud Balances	Determination of mud densities
Pressurized Mud Balance	Pressurized mud balance for determining mud densities
Brookfield Viscometer	Used to measure the viscosity of thixotropic fluids at ultra-high and ultra-low flow rates
Garret Gas Train	Used for determining sulfides and carbonates
Laboratory Centrifuge	Used to separate out solids
Particle Plugging Apparatus	Test sealing effectiveness of mud systems
Slotted Discs	Used for LCM evaluation
Turbidity Meter	Used to measure turbidity in NTU
DO Meter	Used to measure dissolved oxygen
Methylene Blue Test	Identification and quantity of reactive shale
Corrosion Coupon Analysis	Determination of corrosion rate

## Laboratory equipment

### Silverson Mixers – model L5MA

- **Capacity:** 1 mL up to 12 l
- **Motor unit:** Robust two-piece designed for cool, quiet, continuous operation
- **Motor:** 1 hp (750 w) 220 volt, single phase, 50/60 Hz.  
Nominal maximum speed 8,000 rpm (6,000 rpm under full load)
- **Speed control:** Infinitely variable electronic speed control with integral on/off switch
- **Electric rise and fall bench stand:** The mixing unit may be effortlessly raised and lowered using the push-button control on the motor unit
- **Dimensions:** 94.72 x 30.5 x 51.2 cm (37.2 x 12 x 20.1-in.)



### Hamilton Beach® Mixer (1 spindle) with cup HMD200-CE

- Mixes up to twice as fast with more powerful 1/3 hp motors
- Minimizes motor vibration – each motor is individually balanced
- 28-ounce stainless steel mixing cup
- Three speeds plus unique pulse switch for maximum mixing control
- Heavy-duty, die cast construction
- Motors are built to last with sealed, permanently lubricated ball bearings
- Two ways to start and stop mixing cation: With pulse or cup guide
- Removable cup guides clean up quickly in a dishwasher



### Hamilton Beach® Mixer (3 spindle) with 3 cups HMD400-CE

- Mixes up to twice as fast with more powerful 1/3 hp motors
- Minimizes motor vibration – each motor is individually balanced
- Three speeds plus unique pulse switch for maximum mixing control
- Heavy-duty, die cast construction
- Motors are built to last with sealed, permanently lubricated ball bearings
- Removable cup guides clean up quickly in a dishwasher



### Brookfield DV2-LVT Viscometer

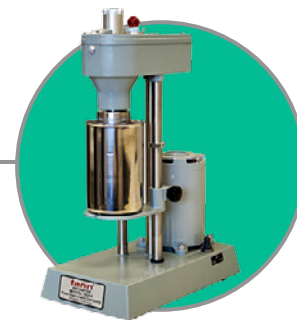
- Set measurement time
- Connects to PC
- **Measurement range:** 1 to 6 m Cp
- **Speeds:** 0.1 to 100 rpm
- **Accuracy:** +/-1% of range
- **Maximum working temperature:** 200°C (392°F) – with heating cup



## QATAR LAB CAPABILITIES

### Fann 35 Viscometer

- **Six speeds:** 600, 300, 200, 100, 6, & 3
- **Dimensions:** 39 x 15 x 27 cm (15.3 x 5.9 x 10.6-in.)
- **Weight:** 6.8 kg (14.9 lb)
- Different combinations of rotor, bob, and spring
- **Maximum working temperature:** 200°C (392°F) – with heating cup



### OFITE 800 Viscometer

- Suitable for both field and laboratory use
- Wide variety of bob and torsion springs available for a variety of fluids tests
- **Eight speeds:** 600, 300, 200, 100, 60, 30, 6, & 3
- **Dimensions:** 56 x 36 x 25 cm (22 x 14.1 x 9.8-in.)
- **Weight:** 11 kg (24.2 lb)
- **Maximum working temperature:** 93°C (199.4°F) – with heating cup



### pH Meter – OAKTON ION 700

- **pH range:** 0.00 to 14.00
- **Resolution:** 0.01 pH
- **Accuracy:** 0.01 pH
- **Temperature range:** 0 to 100°C (32 to 212°F)



### OFITE Emulsion Electrical Stability Tester ES-02

- Measures emulsion stability and wettability in oil-based muds
- **Sine wave:** 340 Hz +/-10
- **Output units:** Peak volts
- **Dimensions:** 24.1 x 16.5 x 8.9 cm (9.4 x 6.4 x 3.5-in.)
- **Weight:** 1.3 kg (2.8 lb)



### Corning Magnetic Stirrer & Heater

- Temperature setting controlled by microprocessor
- 5°C (41°F) increments on LED display
- **Temperature range:** 5 to 550°C (41 to 1,022°F)
- **Stirring speed:** 60 to 150 rpm

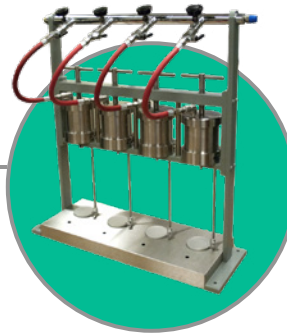




## QATAR LAB CAPABILITIES

### API Filter Press OFITE 140-40

- Stainless steel test cells
- **Maximum pressure:** 100 psi
- **Filter paper size:** 8.89 cm (3.5-in.)



### Retort OFITE 165-14-3 50 mL

- Retort with electronic temperature controller
- **Dimensions:** 24 x 22 x 43 cm (9.4 x 8.6 x 16.9-in.)
- **Weight:** 12.8 kg (28.2 lb)
- **Maximum temperature:** 537°C (998.6°F)



### Roller Oven OFITE 176-00-C

- Can hold 12 x 250 mL aging cells or 8 x 500 mL aging cells
- Variable speed controller
- **Temperature range:** 38 to 315°C (100.4 to 599°F)
- **Motor speed:** 25 rpm
- **Dimensions:** 102 x 81 x 91 cm (40.1 x 31.8 x 35.8-in.)
- **Weight:** 145.4 kg (320.5 lb)



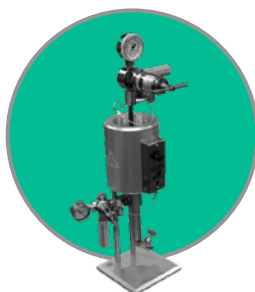
### Permeability Plugging Tester OFITE 171-90-01

- The Permeability Plugging Apparatus (PPA) is designed to provide accurate simulation and measurement of down-hole static filtration. This 4,000 psi rated PPA is ideal for predicting how a drilling fluid can form a permeable filter cake to seal off depleted/under pressure intervals. The PPA utilizes an HTHP Heating Jacket to simulate reservoir temperature. The fluid cell has pressure applied from the bottom of the cell and filtrate collected out the top. Pressure is transferred to the mud by a hydraulic hand pump through a small floating piston within the cell. The PPA employs a ceramic filter disc, which is available in varying porosities. The disc offers a more authentic representation of the formation. This test can be performed at conditions up to a pressure of 4,000 psi and temperature of 500°F. Additional LCM material can be evaluated for plugging of the fracture by using different sizes of slotted discs.



### High-Pressure, High-Temperature Filter Press

- **Rated working pressure:** 1,800 psi
- **Maximum temperature:** 176.6°C (350°F)
- **Back Pressure Receiver Volume:** 15 mL
- **Sample volume:** 173 mL
- **Filtering area:** 3.5-in.<sup>2</sup>



### Pressurized Fluid Density Scale

**Compliance:** ISO 13503-1, API RP 39

**Density measurement ranges:**

- 6.9 to 21.9 ppg
- 0 to 2.63 specific gravity



