ACID FRACTURE CONDUCTIVITY METER

ACM 3000

Laboratory system for carbonate formation acid fracturing simulation

20,000 psi	3,000 psi	1,000 psi	177°C
Max closure stress	*Max fracture pressure*	*Max acid pressure*	*temperature*

ACM 3000 — Complete acid fracturing laboratory system

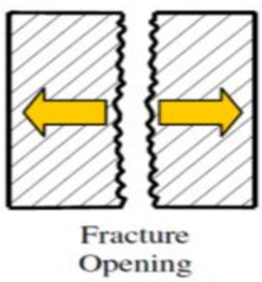
How Acid Fracturing Works

In carbonate reservoirs, acid fracturing is used in place of conventional propped fracturing to create permanent conductive flow paths. The ACM 3000 reproduces the three phases of the process under realistic in-situ conditions of stress, temperature and flow.

1

HYDRAULIC FRACTURING

Fracture opening

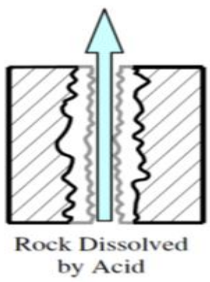


High-pressure fluid creates a fracture in the carbonate rock formation, opening a pathway for acid injection.

2

ACID ETCHING

Rock dissolved by acid

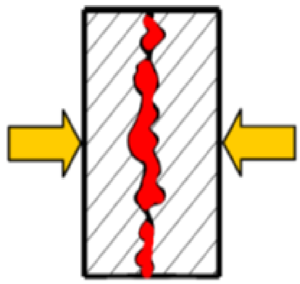


Acid is injected through the fracture and reacts with the carbonate rock, creating irregular etched surfaces along the fracture walls.

3

FRACTURE CONDUCTIVITY

Fracture closing



Under closure stress, the etched asperities keep the fracture open, creating permanent conductive channels for hydrocarbon flow.

The ACM 3000 reproduces all three phases under realistic in-situ conditions.

THE SYSTEM CAN BE CONFIGURED FOR

Acid etching experiments — hot-acid circulation through coated carbonate slabs to generate realistic etched patterns.
Short-term & long-term conductivity experiments — measure K·wf via Darcy's law, study creep and proppant embedment over time.

Why Choose the ACM 3000

Carbonate stimulation requires more than a generic conductivity rig. The ACM 3000 is purpose-built to reproduce every phase of acid fracturing on real rock — from hot-acid etching with realistic leak-off to long-duration conductivity testing under closure stress.

Faithful Simulation

Acid fracturing reproduced on real carbonate samples under in-situ conditions.

Acid Etching

Realistic etched fracture surfaces generated by hot-acid circulation.

Short & Long Term

Both rapid evaluations and four-stage in-situ duration tests supported.

Realistic Conditions

Stress, temperature and flow all controlled to match downhole environments.

Propped or Unpropped

Flexible — test acid-etched fractures with or without proppant placement.

Leak-off Monitoring

Fluid loss measured continuously during the etching phase via dedicated balance.

REAL RESULTS — CARBONATE SLAB FACE

Comparison of a carbonate slab face before and after acid etching in the ACM 3000. The system produces irregular, realistic etched patterns — not idealised channels — matching the geometry of a real downhole etched fracture.

Slab face before acid etching

Slab face after acid etching

Three Test Protocols

The ACM 3000 supports a full acid-fracturing workflow — from generating realistic etched surfaces to evaluating fracture conductivity over short and long durations under closure stress.

A — ACID ETCHING

Hot-acid circulation

Generate realistic acid-etched fracture surfaces.

STEPS

1. Prepare two coated carbonate slabs (1.5" × 3.5")
2. Mount the silicone-sleeved slabs in the cell, spaced by a 3 mm gap (no axial load)
3. Fill acid tank; set pre-heater to target temperature (up to 175 °C)
4. Start membrane pump — circulate acid through the fracture (up to 1 L/min at 1,000 psi)
5. Monitor fluid leak-off and cell temperature during the etching phase
6. Collect spent acid; disassemble and record the etching pattern

DURATION

variable

B — SHORT-TERM

Fast conductivity evaluation

Evaluate how variables affect conductivity of an acid-etched fracture under short exposure.

STEPS

1. Mount the silicone-coated stack of acid-etched slabs inside the cell
2. Install cell on the hydraulic press; set cell & leak-off pressures and temperature
3. Apply closure stress (ramped up to target, max 20,000 psi)
4. Inject test fluid — brine (2% KCl) or N_2 gas — at controlled rate
5. Record flow rate, ΔP, cell pressure and temperature
6. Compute K·wf via Darcy's law at several conditions

PARAMETERS

fracture conductivity via Darcy's law using brine (2% KCl) or N_2

C — LONG-TERM

Four-stage in-situ simulation

Realistic long-term simulation: fluid loss, embedment and flow-back in four stages.

STEPS

1. Stage 1 — Static fluid loss: hold at 500 psi initial closure, monitor leak-off
2. Stage 2 — Shut-in: ramp to final stress and temperature, hold ~12 h
3. Stage 3 — Flow-back: inject brine at the maximum sand-free flow rate
4. Stage 4 — Conductivity measurement: compute K·wf via Darcy's law
5. Record creep deformation and proppant embedment throughout
6. Repeat with different proppant sizes and concentrations

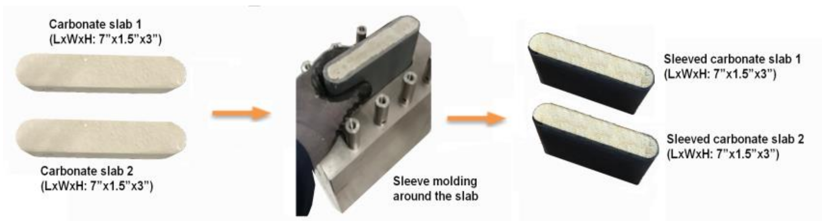
PARAMETERS

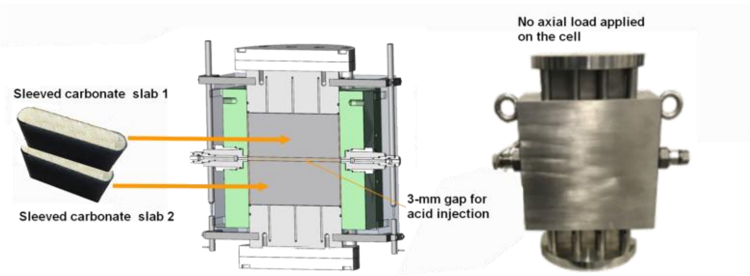
creep, embedment, proppant size & concentration

Specimen Preparation

The ACM 3000 uses real carbonate slabs sleeved in silicone to enforce one-dimensional acid attack. Once etched, the same slabs are stacked and re-mounted for conductivity testing — preserving the etched geometry from the first phase to the second.

STEP 1 · ACID ETCHING





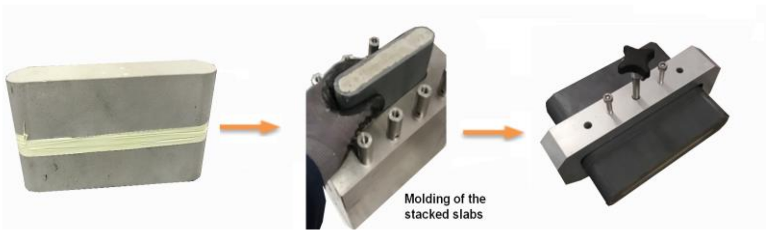
Process

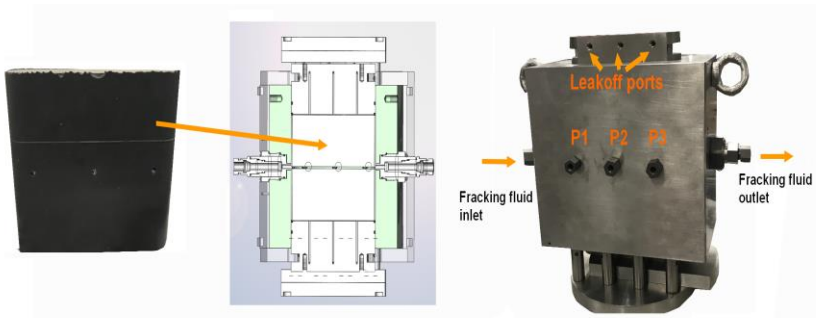
Two carbonate slabs (7" × 1.5" × 3") are silicone-sleeved in a dedicated mold
The sleeve confines acid attack to a controlled face area — replicating the geometry of a real fracture wall.

Specimen dimensions
Length: 7 in · Width: 1.5 in · Height: 2×3.5 in

Etching gap: 3 mm between sleeved slabs (no axial load applied during etching).

STEP 2 · FRACTURE CONDUCTIVITY





Process

Two carbonate slabs are stacked with or without proppants between the acid-etched faces, then silicone-coated in a mold.

Holes are precisely created in the sleeve at exact dimensions using a dedicated tool to allow controlled fluid flow. The specimen is then mounted in the cell.

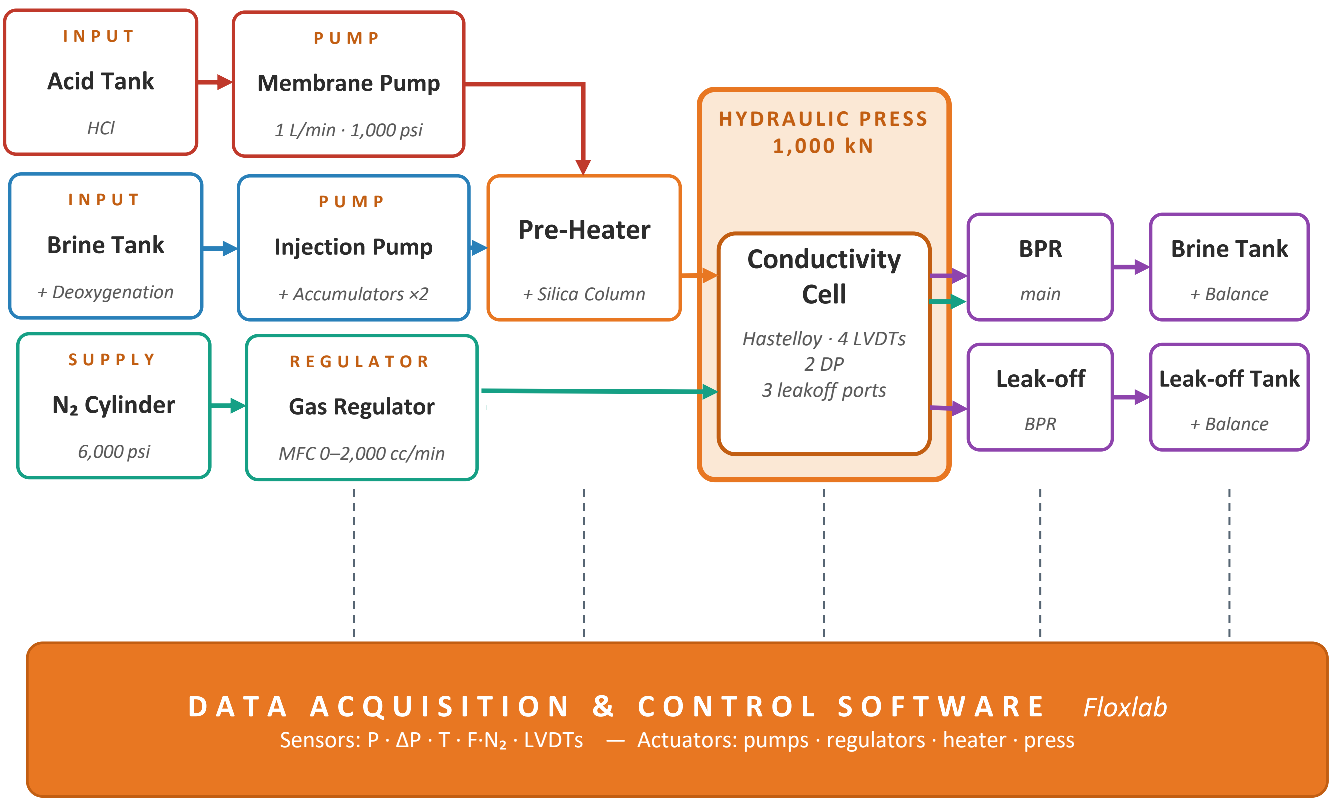
After applying closure stress and setting temperature and fluid pressure, fluids such as brine (2% KCl) or nitrogen are injected at constant pressure while the pressure drop across the specimen is measured. Fracture conductivity is determined using Darcy's law during short exposure.

Specimen dimensions
Length: 7 in · Width: 1.5 in · Height: 7.5 in

System Architecture

Functional block diagram showing how fluids, gas and signals flow through the ACM 3000. Three input lines (acid, brine, N_2) converge on the heated Hastelloy conductivity cell mounted in the hydraulic press; two outlet paths return to weighed collection tanks for mass-balance accounting.

FUNCTIONAL BLOCK DIAGRAM



MAIN COMPONENTS

FLUIDS & PUMPS

- Brine injection pump + accumulators ×2
- Brine deoxygenation column
- Acid membrane pump (1 L/min · 1,000 psi)
- N_2 regulator + mass flow controller

CORE TEST SECTION

- Inline pre-heater + silica column
- Heated fracture conductivity cell
- Hydraulic press (1,000 kN)
- 4 LVDTs + 3 P-taps + thermocouple

OUTLETS & CONTROL

- Main back-pressure regulator
- Leak-off back-pressure regulator
- Two electronic balances (0.01 g)
- Floxlab DAQ & control software

Technical Specifications

Engineered for laboratories simulating acid fracturing in carbonate formations under realistic in-situ conditions — Hastelloy wetted parts ensure full chemical compatibility with reservoir acids.

20,000 psi
Max closure stress

3,000 psi
Max fracture pressure

1,000 psi
Max acid pressure

177 °C
Max temperature

ACC Series — Acid Fracture Cell

Designed for carbonate acid-frac simulation

Max temperature	**177 °C (350 °F)**
Fluid pressure	**up to 3,000 psi**
Closure stress	**up to 20,000 psi**
Sample length	**7 in**
Sample width	**1.5 in**
Sample height	**2 × 3.5 in**
Wetted parts	**Hastelloy**
Cell features	**4 LVDTs · 3 P-taps · heated**

Hydraulic Press & Servo Pump

1,000 kN compression frame · stiff & compact

Compression	**1,000 kN**
Closure pressure	**20,000 psi**
Press weight	**500 kg**
Pump pressure	**10,000 psi**
Pump volume	**250 cc**
Pump flow	**0.0001–50 cc/min**

ACCUMULATORS, INJECTION PUMP & BPR

Floating piston accumulators: 10,000 psi · 1,000 cc · stainless steel · 20 kg.
Injection pump (CF model): 3,000 psi · 2 × 40 cc · 0.0001–80 cc/min · stainless steel.
Back-pressure regulator: 3,000 psi · stainless steel.

INSTRUMENTATION

- Cell pressure transducer: 0–3,000 psi (0.15%)
- ΔP transducers: 0–0.9 psi & 0–9 psi (0.025%)
- Gas ΔP transducer: 0–150 psi
- N_2 mass flow controller: 0–2,000 cc/min
- Two electronic balances: 0–2,500 g (0.01 g)
- Floxlab data acquisition & control software

Get in Touch

We are happy to discuss your acid-fracturing testing requirements.

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Thank you for your interest in the ACM 3000