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PROPPANT CONDUCTIVITY SYSTEM

PCM 1000

Automated fracture conductivity measurement
under high closure stress

ISO 13503-5 | API RP 56 | API RP 58

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Overview

The PCM 1000 measures proppant pack and fracture conductivities under reservoir-representative pressures and temperatures. Its automated test sequences deliver rapid, accurate and reproducible data — fully compliant with ISO 13503-5 and API RP 56 & 58.

PURPOSE

- Measures proppant pack and fracture conductivities
- Operates under high closure stress and high temperature
- Compatible with brine or gas (N_2) as test fluid

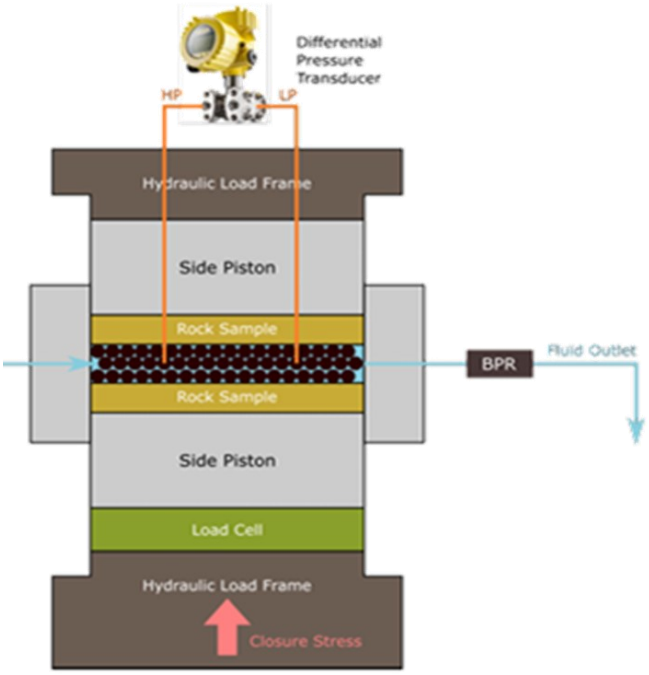
KEY BENEFITS

- Fully automated test sequences
- Rapid, accurate, reproducible data
- Closure stress up to 20,000 psi
- ISO 13503-5 / API RP 56 & 58 compliant

MEASURED PARAMETERS

- Closure pressure
- Flow pressure & temperature
- Pressure drop (ΔP)
- Brine flow & gas flow
- Pack width

HOW IT WORKS — TEST CELL SCHEMATIC



Operating principle

A proppant pack is placed between two Ohio sandstone slabs and held in an API conductivity cell under controlled closure stress. Pre-heated, degassed brine — or nitrogen for compressible-fluid tests — is injected through the pack. Permeability and conductivity are derived from the differential pressure (ΔP) measured across the pack via Darcy's law.

Test Protocol

Proppant pack conductivity measurement procedure

1. Place two Ohio sandstone slabs between the steel platens of the API conductivity cell.
2. Position the proppant pack between the sandstone slabs.
3. Install the cell in the hydraulic compression frame and apply closure stress (1,000 – 20,000 psi).
4. Heat the cell to target reservoir temperature (up to 177 °C / 350 °F).
5. Pre-heat and degas the brine before injection.
6. Inject brine through the pack at controlled flow rate (up to 1,000 psi).
7. Monitor differential pressure (ΔP) across the proppant pack in real time.
8. Compute permeability and conductivity using Darcy's law.
9. Repeat at increasing closure pressures — conductivity decreases with stress due to proppant crushing and embedment.

TEST CONDITIONS

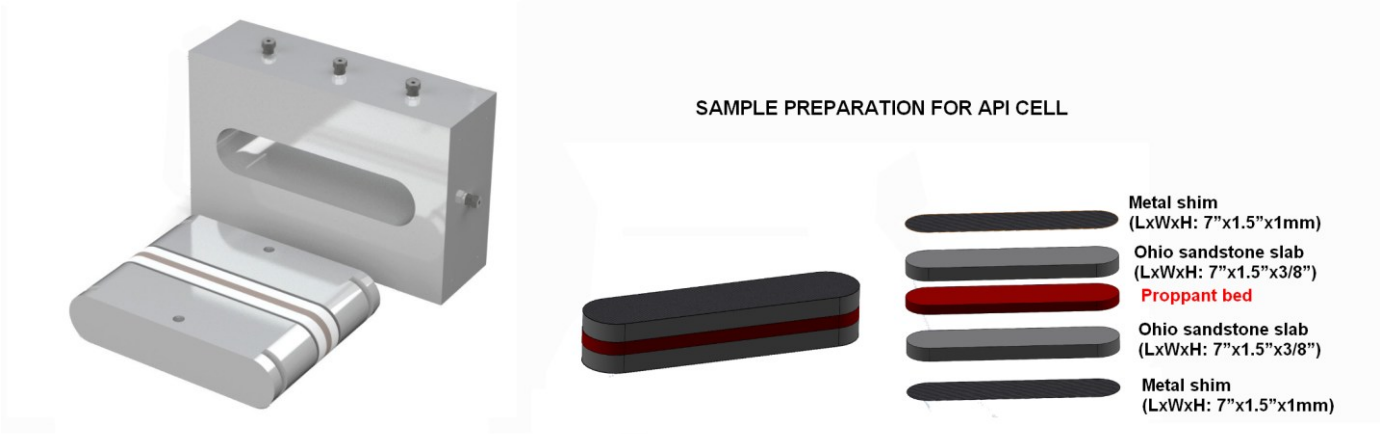
Closure pressure	Temperature	Injection pressure	Test fluid
1,000 – 20,000 psi	**ambient – 177 °C**	**up to 1,000 psi**	**Pre-heated degassed brine / N_2**

PARAMETERS ASSESSED

Proppant concentration ◆ Proppant geometry ◆ Proppant uniformity ◆ Proppant transportability ◆ Proppant strength

Sample Preparation

Proppant Conductivity Cell — sample assembly for API conductivity testing



ASSEMBLY

The sample consists of a proppant bed placed between two Ohio sandstone slabs and covered by a metal shim. The assembled stack is then inserted into the API conductivity cell between two loading pistons. The shim ensures a uniform fracture face and protects the platens during compression.

STACK COMPONENTS

Metal shim

L × W × H : 7" × 1.5" × 1 mm

Ohio sandstone slab

L × W × H : 7" × 1.5" × 3/8"

Proppant bed

Test specimen — placed between slabs

Ohio sandstone slab

L × W × H : 7" × 1.5" × 3/8"

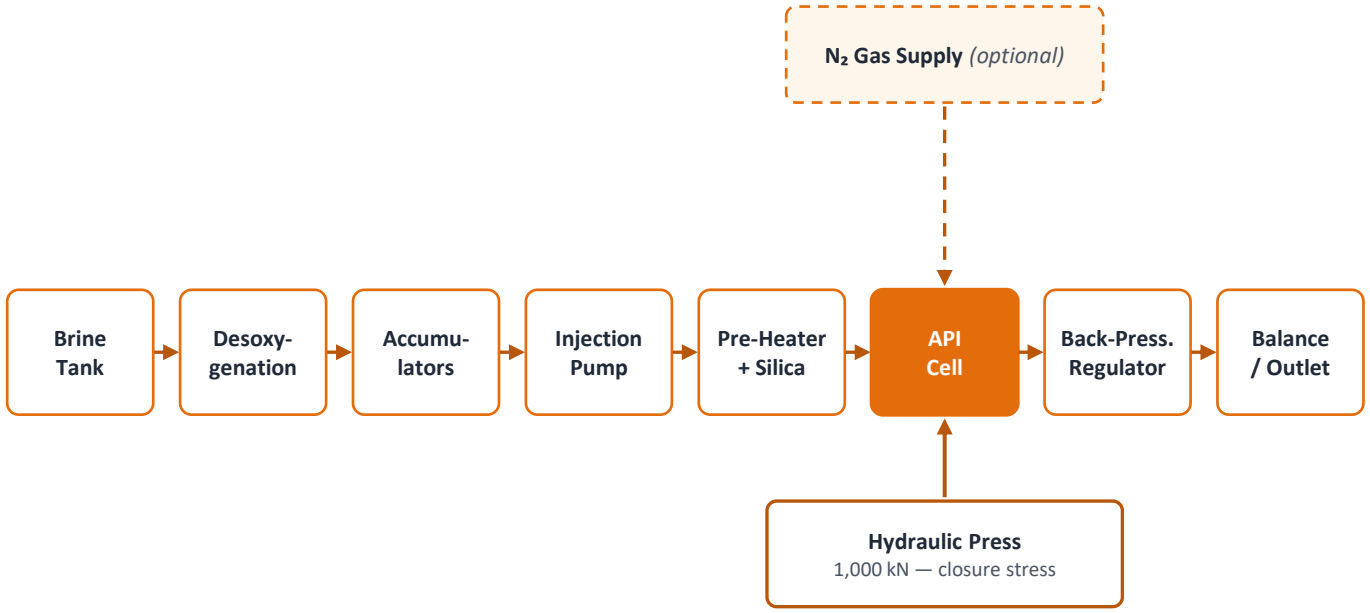
Metal shim

L × W × H : 7" × 1.5" × 1 mm

System Architecture

Main components and process flow diagram

SYSTEM BLOCK DIAGRAM



SENSORS AT API CELL · ΔP transducer · 4 LVDTs (fracture width) · Temperature probe · Cell-pressure transducer

MAIN COMPONENTS

- Injection pump
- Brine accumulators with desoxygenation
- Inline heater with silica column
- API conductivity cell with heating system
- Proppant pack width LVDT meter
- Hydraulic press (1,000 kN / 100 T)
- Back-pressure regulator
- Electronic balance
- P and ΔP transducers
- Gas flow line (optional, N_2)

PROCESS OVERVIEW

End-to-end view of the brine and gas circuits: from desoxygenation and accumulation, through the heater and silica column, to the API conductivity cell instrumented with LVDTs and pressure transducers, and on to the back-pressure regulator and electronic balance for accurate flow measurement.

20,000 psi
Max closure stress

177 °C
Max temperature

Conductivity Cells

PCC and SAC series — single and stacked cell configurations

PCC SERIES

Single-cell conductivity

SPECIFICATIONS

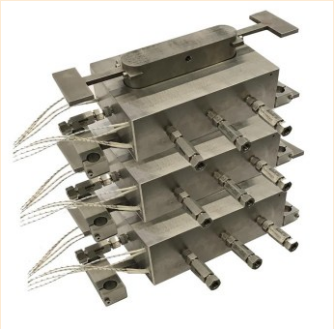
Standard	**ISO 13503-5**
Load capacity	**1,000 kN (100 T)**
Max closure stress	**20,000 psi**
Max pore pressure	**1,000 psi**
Temperature	**ambient – 177 °C**
Pack thickness	**± 0.001 in**
Specimen	**7 × 1.5 × 3/8 in**
Wetted parts	**Stainless steel**
N_2 / Air	**2,000 / 100 psi**

KEY ELEMENTS

- Heated steel platens — precise temperature
- Thermocouple monitoring
- Two 3/8-inch Ohio sandstone slabs
- Metal shim
- 3 pressure taps for monitoring
- 4 LVDTs measuring fracture width

SAC SERIES

Stacked multi-cell assembly



SPECIFICATIONS

Standard	**ISO 13503-5**
Load capacity	**1,000 kN (100 T)**
Max closure stress	**20,000 psi**
Max pore pressure	**1,000 psi**
Temperature	**ambient – 177 °C**
Pack thickness	**± 0.001 in**
Specimen	**5 × 1.5 × 3/8 in**
Stacking	**Up to 2 or 3 cells**
N_2 / Air	**2,000 / 100 psi**

KEY ELEMENTS

- Heated steel platens (per cell)
- Dedicated thermocouple per cell
- Two 3/8-inch Ohio sandstone slabs
- Metal shim
- 3 pressure taps per cell
- Shared piston — simultaneous testing

Press, Pump & Instrumentation

Hydraulic press, axial pump, accumulators, BPR and full sensor suite

Hydraulic Press

Max compression
1,000 kN (100 T)
Closure pressure
up to 20,000 psi
Horizontal clear.
325 mm
Vertical clear.
315 mm
Weight
750 kg

Injection Pump (CF3)

Max pressure
1,000 psi
Volume
2 × 40 cc
Flow rate
0.0001 – 80 cc/min
Wetted parts
Stainless steel
Power
110-220 VAC, 50/60 Hz

Back-Pressure Regulator

Working pressure
1,000 psi
Wetted parts
Stainless steel
Function
Outlet pressure control
Integration
In-line on brine return
Maintenance
Field-serviceable

INSTRUMENTATION

- Cell pressure transducer: 0–1,000 psi (0.15%)
- Low ΔP transducer: 0–0.9 psi (0.025%)
- Mid ΔP transducer: 0–9 psi (0.025%)
- Gas ΔP transducer: 0–150 psi
- N_2 mass flow controller: 0–2,000 cc/min
- Temperature probe on conductivity cell
- Electronic balance: 0–2,500 g (0.01 g)
- Floxlab data acquisition & control software

ACCESSORIES

Electronic balance

Precision weighing for proppant sample preparation.

Vacuum pump

Air evacuation from fluid lines prior to test start.

Sleeve shaker

Mechanical sieving for particle-size distribution.

Floating piston accumulators

3,000 psi · 1,000 cc · stainless steel

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