



REFERENCE DATASHEET · CORE ANALYSIS

# Coretest Automated Core Centrifuge

High-speed centrifuge with camera readout for drainage and imbibition capillary pressure on core plugs



## 13,000 rpm

maximum speed,  $\pm 20$  rpm

## 3 × 1.5" × 2"

core plugs per run

## Drainage + imbibition

interchangeable standard and inverted bucket sets

## Camera readout

stroboscope and camera read each measuring tube during rotation

## Automatic level detection

produced volume logged against time and speed

## up to 31,420 ×g

imbibition rotor, outer plug face

## 1 System function

The centrifuge measures capillary pressure on core plugs by the centrifuge method. Plugs spin in sealed buckets at a series of speed steps. At each step the centrifugal field displaces liquid from the plug until equilibrium; a camera synchronised with a stroboscope images the measuring tube of every bucket once per revolution, so the produced volume is read while the rotor turns, without stopping the run.

Main uses:

- primary drainage capillary pressure curves, air–brine, air–oil or oil–brine;
- forced imbibition curves with inverted buckets on the same rotor yoke;
- USBM wettability index from a drainage and imbibition pair;
- irreducible water saturation and plug preparation at  $S_{wi}$ .

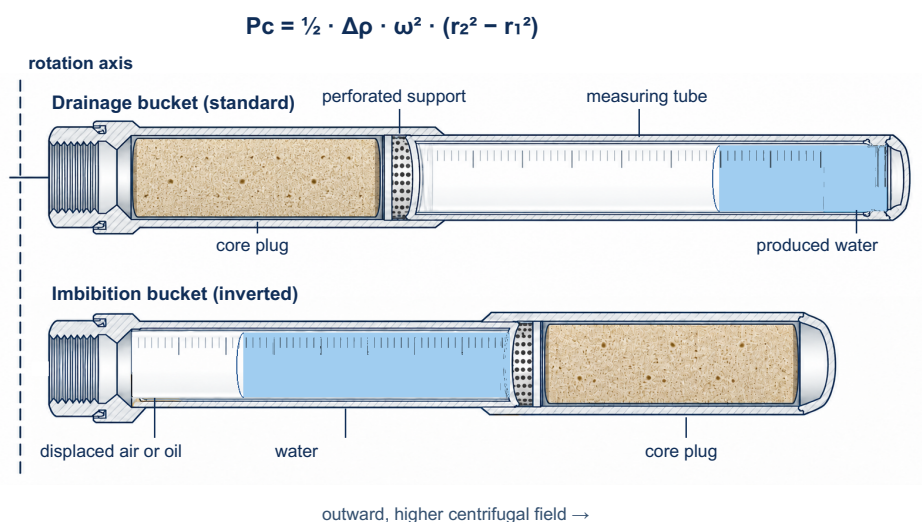


Figure 1. Bucket layouts, schematic (plug face radii for  $P_c$  are listed in section 3). Drainage: water displaced from the saturated plug collects at the outer end of the measuring tube. Imbibition: the plug (dry for air–water, or at  $S_{wi}$  with oil for oil–brine) sits at the outer end and the tube is filled with water before the run; water is driven into the plug and the displaced air or oil rises to the inner end of the tube, where its volume is read. Units:  $\Delta\rho$  in  $\text{kg/m}^3$ ,  $\omega$  in  $\text{rad/s}$ ,  $r$  in  $\text{m}$ ,  $P_c$  in  $\text{Pa}$ .

## 2 Controlled variables and measured outputs

| Controlled                                           | Measured or calculated                             |
|------------------------------------------------------|----------------------------------------------------|
| Rotor speed per step, up to 13,000 rpm, $\pm 20$ rpm | Liquid level in each tube, imaged every revolution |
| Step duration, up to 23 h 59 min                     | Produced volume against time and speed             |
| Chamber temperature, 20 to 40 °C during tests        | Average saturation per step                        |
| Chamber vacuum, to limit air drag and heating        | Capillary pressure curve, USBM index               |

## 3 Rotor and buckets

Drainage and imbibition use interchangeable bucket sets on the same rotor yoke; one set is fitted per run. The plug sits in a titanium core chamber; rotor body and buckets are anodised aluminium; measuring tubes are polycarbonate. Each bucket is sealed by O-rings and a vent screw keeps it at atmospheric pressure during the run. Rotor and buckets are rinsed after runs with brine to protect the aluminium.



Rotor with drainage buckets



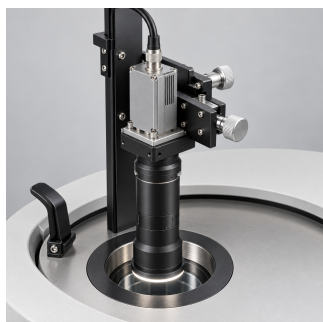
Rotor with inverted imbibition buckets

| Parameter                                  | Drainage rotor                                                                                                                            | Imbibition rotor   |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Plugs per run                              | 3                                                                                                                                         | 3                  |
| Plug size, standard / maximum              | 1.5 × 2 in / 1.555 × 2.010 in                                                                                                             |                    |
| Inner / outer plug face radius             | 43.0 / 93.8 mm                                                                                                                            | 115.5 / 166.3 mm   |
| RCF at inner / outer plug face, 13,000 rpm | 8,120 / 17,720 ×g                                                                                                                         | 21,820 / 31,420 ×g |
| Standard measuring tube                    | 6 mL, 0.1 mL graduation; other volumes per project                                                                                        |                    |
| Maximum plug density                       | 2.82 g/ml                                                                                                                                 |                    |
| Maximum imbalance between buckets          | 0.3 g                                                                                                                                     |                    |
| Rotor service life                         | up to 13,000 rpm for 1,000 runs or 2,500 h, whichever comes first; after that up to 10,000 rpm until 5 years from first use, then retired |                    |

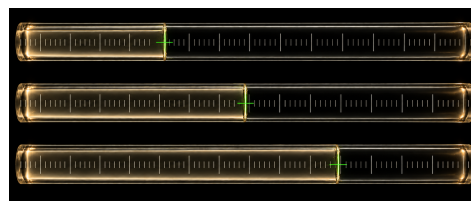
Capillary pressure follows from the formula in Figure 1 with the radii above, the set speed and the density difference of the fluid pair.

## 4 Camera readout and software

A stroboscope fires once per revolution in phase with each bucket, and an industrial camera above the lid window captures the measuring tube. The software finds the liquid level in each image automatically and converts it to produced volume. Results are logged against time and speed, equilibrium is judged per step, and the capillary pressure curve is calculated from the equilibrium points using the Hassler–Brunner or Forbes approximation. The produced volume against time within each step is kept with the run data and can be exported for relative permeability interpretation.



Camera and stroboscope above the lid window (illustration)



Measuring tubes imaged during rotation

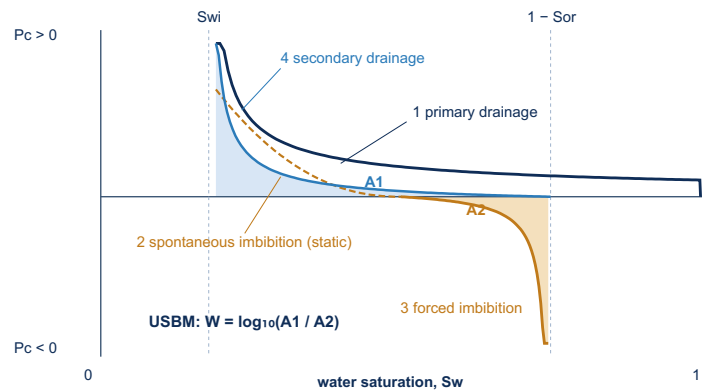


Figure 2. Typical oil–brine test sequence, schematic: primary drainage to  $Sw_i$ , spontaneous imbibition (static, at zero capillary pressure, outside the centrifuge), forced imbibition with the inverted buckets, and secondary drainage.  $A_1$  is the area under the secondary drainage curve and  $A_2$  the absolute area of the forced imbibition curve;  $W = \log_{10}(A_1/A_2)$ ,  $W > 0$  water-wet,  $W < 0$  oil-wet.

## 5 Specifications

| Parameter                | Value                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------------|
| Maximum speed / accuracy | 13,000 rpm / $\pm 20$ rpm                                                                          |
| Timer                    | up to 23 h 59 min per step                                                                         |
| Test temperature         | 20 to 40 °C (chamber setting from 20 °C; 40 °C limit of the polycarbonate measuring tubes)         |
| Control                  | 10 in touch screen; industrial computer for imaging and data                                       |
| Chamber                  | vacuum system to reduce air drag and heating at speed                                              |
| Protection               | lid lock, overspeed, imbalance                                                                     |
| Power supply             | 220 V $\pm 10$ %, 50 Hz, single phase, 30 A, independent protective earth; 60 Hz supply on request |
| Ambient                  | 10 to 35 °C, relative humidity up to 85 %                                                          |
| Dimensions (L × W × H)   | 700 × 900 × 1300 mm                                                                                |
| Net weight               | 450 kg                                                                                             |
| Utilities                | electrical only; no water or drain connection                                                      |

## 6 Standard project deliverables

| Item                                                                          | Qty                   |
|-------------------------------------------------------------------------------|-----------------------|
| Centrifuge with vacuum system and touch-screen control                        | 1                     |
| Rotor yoke with drainage buckets, 1.5 in, adapters and measuring tubes        | 1 set, 2 adapter sets |
| Inverted imbibition buckets, 1.5 in, adapters and measuring tubes             | 1 set, 2 adapter sets |
| Imaging system: industrial computer, camera, stroboscope, connection hardware | 1                     |
| Acquisition and capillary pressure software with automatic level detection    | 1 licence             |
| Operation manual and factory test report                                      | 1                     |

Installation, commissioning, training, delivery and warranty terms are defined in the commercial proposal. A rotor for 1 in plugs is available on request.

## 7 RFQ inputs

- plug diameter and length, number of plugs per run;
- fluid pair and densities (brine salinity, oil type);
- drainage only, or drainage and imbibition;
- produced volume per plug and reading resolution needed;
- site power supply (voltage, frequency, phases).

This document defines the product family. Guaranteed performance, included hardware, exclusions, interfaces and acceptance criteria are stated only in the project-specific technical proposal and approved datasheet. Images are for reference; delivered configuration may differ.