True Density & Tapped Density Analyzers

• Mining  • Pharmaceutical   • Foams
• Food Powders  • Spices & Grains

PENTAPYC™ 5200e

Five station, automatic pycnometer for specific volume and true (skeletal) density determination of porous solids and powders. Each of the five stations can be individually “tailored” for different sample amounts and shapes. Stand alone operation and 2-way ethernet communication to PC, interface to electronic balance and direct printing of results. Easy-seal™ covers ensure reproducible operation. A thermostatted version (T-model) for increased temperature stability and control is available.

ULTRAPYC™ 1200e / MICRO-ULTRAPYC™ 1200e

Single station, automatic gas pycnometers for volume measurement of porous solids and powders. The Ultrapyc can measure samples of up to 135 cm³ and down to 0.1 cm³. Other standard features including availability of a thermostatted version are the same as in the Pentapyc. Additional vacuum purge option reduces consumption of analysis gas. “Remote-control” version features separate analyzer and control modules for glove box operation.

ULTRAFoAM™ 1200e / PENTAFoAM™ 5200e

Upgraded gas pycnometers for cellular plastics applications conforming to ASTM D6226. Pre-programmed modes include open and closed cell, isometric compressibility and rigid foam fracture. Both retain all the features of the standard automated pynometers including normal density mode, with rapid switching between methods via keypad or PC.

Open and Closed Cell Content of Rigid Cellular Plastics

Foams and various rigid cellular plastics are formed by trapping gas bubbles in a solid. Typical examples include Styrofoam™ cups and bed mattresses. Based on their pore structure, foams are characterized as open or closed cell structures. In open cell structures the pores are interconnected and can be readily filled with surrounding fluids. When filled with air or water, open cell foams make excellent thermal insulators or sponges. In contrast, pores in closed cell foams are not interconnected. This makes them stronger, denser, and able to float in liquids. Closed pores can be filled with selected gases to improve their performance as heat and sound insulators. Their high resilience, impermeability, and light weight make rubber foams popular as floor mats, gaskets, and shock absorbers.

Visit www.quantachrome.com for more detailed instrument specifications and downloadable brochures.
MULTIPYCNOMETER™

The Multipycnometer™ is the most versatile manual pycnometer available. It gains its name from its multiple volume feature that offers three sizes of interchangeable sample cells: 135 cm³, 20 cm³, and 4.5 cm³. In addition, there are three different calibrated reference volumes which provide peak performance for each cell size. The operating sequence is reversed from that of the Stereopycnometer™; that is, pressurizing the reference volume first, then expanding the gas into the sample cell. This arrangement minimizes dead volume in the sample chamber, thereby leading to increased accuracy on measurements of small samples. Adequate precision is provided through digital pressure displays with resolution as low as 0.001 psi.

STEREOPYCNOMETER™

The Stereopycnometer™ is the standard model of our series of manually operated pycnometers. It offers a choice of two interchangeable sample cells (135 cm³ and 20 cm³ capacity) used in conjunction with a single reference volume. A sample is placed in the sample cell and degassed by purging with a flow of dry gas, by vacuum (pump not included), or by a series of pressurization cycles. The analysis is performed by pressurizing the sample cell then expanding the gas into the reference chamber. From the two pressure readings (displayed on the easy to read digital display) the sample volume can be quickly and accurately calculated. If samples are compressible foams, the cell-to-reference pressure sequence of the Stereopycnometer™ is preferred over that employed by the Multipycnometer™.

AUTOTAP™ / DUAL AUTOTAP™

Tap density analyzers for bulk density and powder packing studies including Hausner Ratio and Carr index for predicting flowability. Built-in counter for error-free operation. Automated one and two sample models feature unique adapters for range of sample cylinder volumes. Rugged construction for trouble-free performance. Both units conform to ASTM test methods B527, D4164 and D4781, MPIF 46, USP<616> method II and ISO 787/11. Also used for envelope (geometric) density measurement by dry powder displacement. The units’ control panel can be disabled thanks to a lock at the front of the instrument, which enables the user to prevent others from tampering with the counter settings. If additional sound insulation is desired, an optional noise reduction cabinet is also available to accommodate either Autotap™ model.

Bulk and Tap Density and Sample Porosity

True and apparent densities can be readily evaluated using automated or manual gas pycnometers. However, many applications also require knowledge of packing density and porosity. Materials that consist of discrete particles, flakes, pellets, or granules contain void spaces between and inside the particles. Voids are regions which contain something other than the considered material. Since bulk density is evaluated by dividing sample mass by bulk volume, voids tend to lower the packing or apparent density of a material. The degree to which bulk density is affected by voids can be precisely measured by controlling packing parameters, as done with Autotap™ tapping density analyzers. For applications requiring the measurements of particle volumes including voids, either non-wetting fluids or solid particles or known dimensions can be used. For example, the PoreMaster™ series mercury porosimeters can determine apparent sample volumes including pores of specified sizes down to 1.8 nm in radius. If the volume of pores with radii below 1.8 nm is significant, or if porosity estimates are required, the use of a helium pycnometer is recommended.

Visit www.quantachrome.com for more detailed instrument specifications and downloadable brochures.
**Comparison of Density Analysis Equipment at a Glance**

<table>
<thead>
<tr>
<th>Instrument Model</th>
<th>Automatic (A) or Manual (M)</th>
<th>No. of Sample Stations</th>
<th>Sample Volume Range [cm³]</th>
<th>Large Sample Cell Precision [%]</th>
<th>No. of Interchangeable Sample Cells</th>
<th>Balance Interface Port</th>
<th>Thermal Control Option</th>
<th>Multi Language Software Capability</th>
<th>Degas by Flow (F), Pulse (P), or Vacuum (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentapyc™ 5200e</td>
<td>A</td>
<td>5</td>
<td>0.1-135</td>
<td>0.01</td>
<td>3 (6')</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>F, P</td>
</tr>
<tr>
<td>PentaFoam™ 5200e</td>
<td>A</td>
<td>5</td>
<td>0.1-135</td>
<td>0.01</td>
<td>3 (6')</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>F, P</td>
</tr>
<tr>
<td>Ultrapyc™ 1200e</td>
<td>A</td>
<td>1</td>
<td>0.1-135</td>
<td>0.01</td>
<td>3 (6')</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>F, P, V</td>
</tr>
<tr>
<td>UltraFoam™ 1200e</td>
<td>A</td>
<td>1</td>
<td>0.1-135</td>
<td>0.01</td>
<td>3 (6')</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>F, P, V</td>
</tr>
<tr>
<td>Micro-Ultrapyc™ 1200e</td>
<td>A</td>
<td>1</td>
<td>0.1-4.2</td>
<td>0.01</td>
<td>3</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>F, P, V</td>
</tr>
<tr>
<td>Multipycnometer™</td>
<td>M</td>
<td>1</td>
<td>0.5-135</td>
<td>0.05</td>
<td>3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>F, P</td>
</tr>
<tr>
<td>Stereopycnometer™</td>
<td>M</td>
<td>1</td>
<td>4.5-135</td>
<td>0.05</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>F, P</td>
</tr>
<tr>
<td>Autotap / Dual Autotap</td>
<td>M</td>
<td>1 or 2</td>
<td>10-1,000</td>
<td>b</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

- a Optional Micro/Meso/Nano Cell Kit Extends Range to 0.1 cm³.
- b Varies with sample cell dimensions, sample volume and/or sample preparation; higher precisions achievable for optimum combinations.
- c Optional vacuum degassing using pump.
- d 250 cm³ is standard; other cylinders with capacities between 10 and 1,000 cm³ are optional.

**Selected International Standards Applicable to Density Analysis**

ASTM D4892-14

ASTM D2638-10

ASTM B923-10
Standard Test Method for Metal Powder Skeletal Density by Helium or Nitrogen Pycnometry.

ASTM UOP851-08
Density of Powders and Solids by Helium Displacement.

ASTM D6093-97(2011)

ASTM D4164-13

ASTM D4781-03(2013)

ASTM B527-14

Visit [www.quantachrome.com](http://www.quantachrome.com) for more detailed instrument specifications and downloadable brochure
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