

# Capillary Flow Porometer

## Applications

The PMI Capillary Flow Porometer is used for R&D and quality control in industries worldwide such as filtration, nonwovens, pharmaceutical, biotechnology, healthcare, household, food, hygienic products, fuel cells, water purification, and battery. Samples often tested include: filter media, membranes, paper, powders, ceramics, battery separators, and health care products.



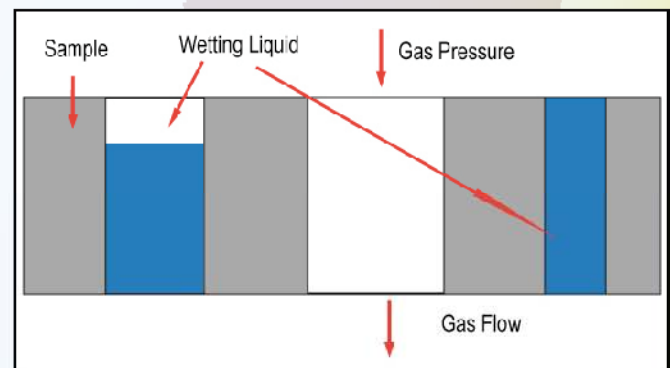
## Principle

A wetting liquid is allowed to spontaneously fill the pores in the sample and a nonreacting gas is allowed to displace liquid from the pores. The gas pressure and flow rates through wet and dry samples are accurately measured.

The gas pressure required to remove liquid from the pores and cause gas to flow is given by:

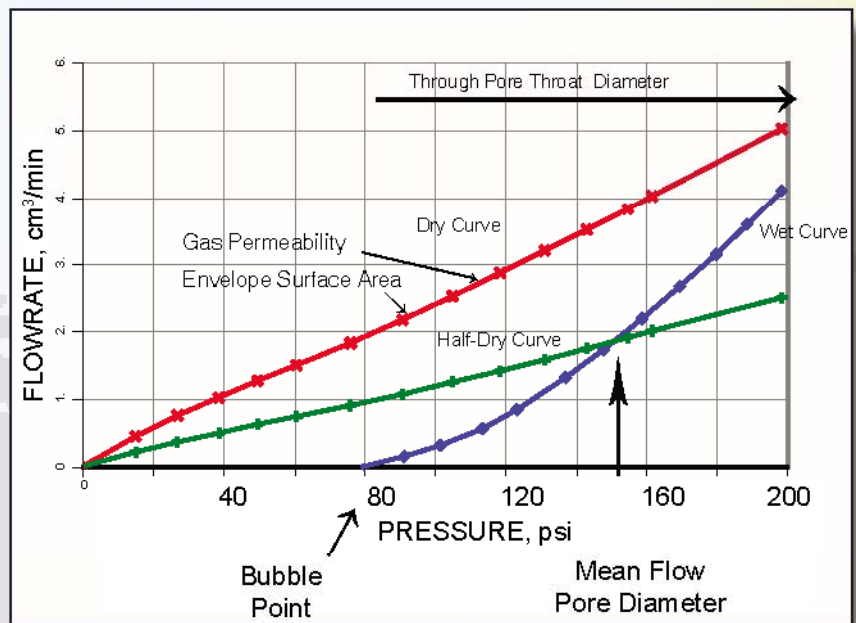
$$D = 4 \gamma \cos \theta / p$$

where  $D$  is the pore diameter,  $\gamma$  is the surface tension of liquid,  $\theta$  is the contact angle of liquid, and  $p$  is the differential gas pressure. From measured gas pressure and flow rates, the pore throat diameters, pore size distribution, and gas permeability are calculated.



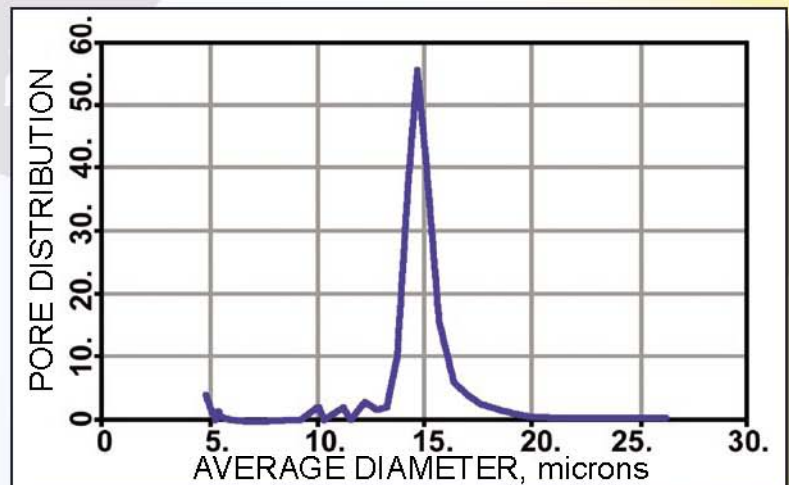
## Features

- Testing of small samples as well as complete parts
- Any sample geometry (Example: sheets, rods, tubes, hollow fibers, cartridges, and powders)
- Any nonwetting liquid
- Tests in QC, research, or any number of user defined modes
- See-through sample chamber for visual observation of test available
- Real time graphic display
- Window based software for all control, measurement, data collection, data reduction, and report preparation



## Special Features

- Adjustable pressure on o-rings through pneumatically controlled piston-cylinder device
- Measurement of pressure close to the sample to minimize pressure drop correction
- Straight flow path avoiding turbulence
- Versatile sample chamber for a variety of samples and test modes



## Capabilities

- Diameter of the most constricted part of a through pore (pore throat)
- Bubble point (the largest through pore throat diameter)
- Mean flow pore diameter (50% of flow is through pores smaller than the mean flow pore)
- Pore diameter range
- Pore distribution

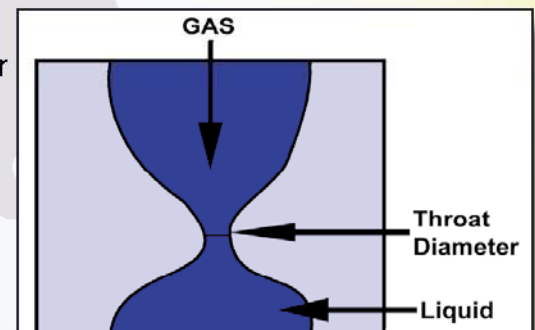
Distribution function f:

$$f = -d[(fw/fd) \times 100] / dD$$

fw = flow rate through wet sample

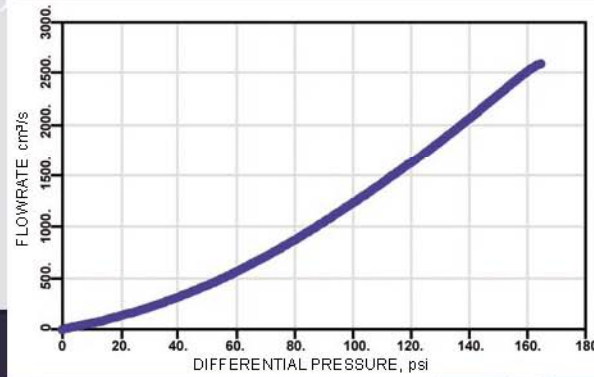
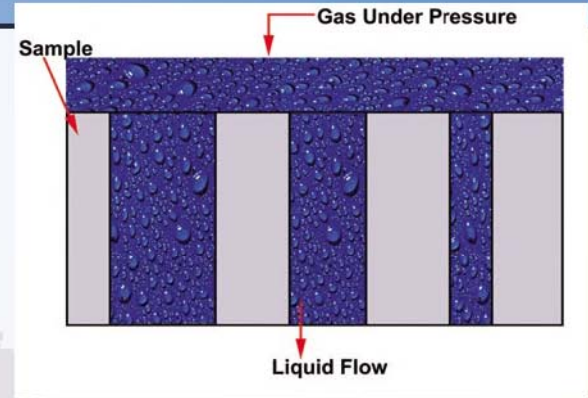
fd = flow rate through dry sample

- Gas permeability in many desired units including Frazier, Gurley, Rayle, and Darcy



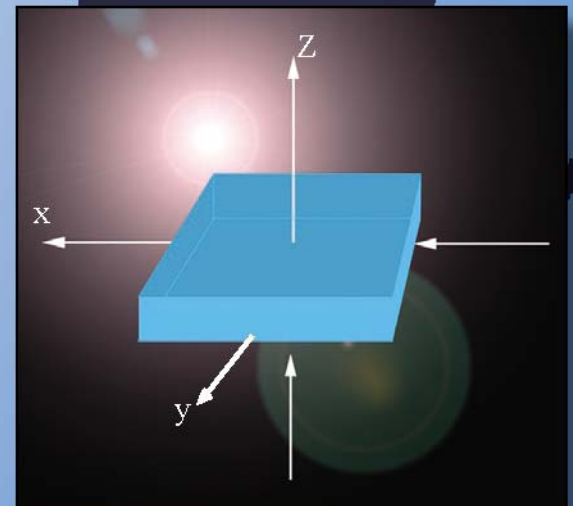
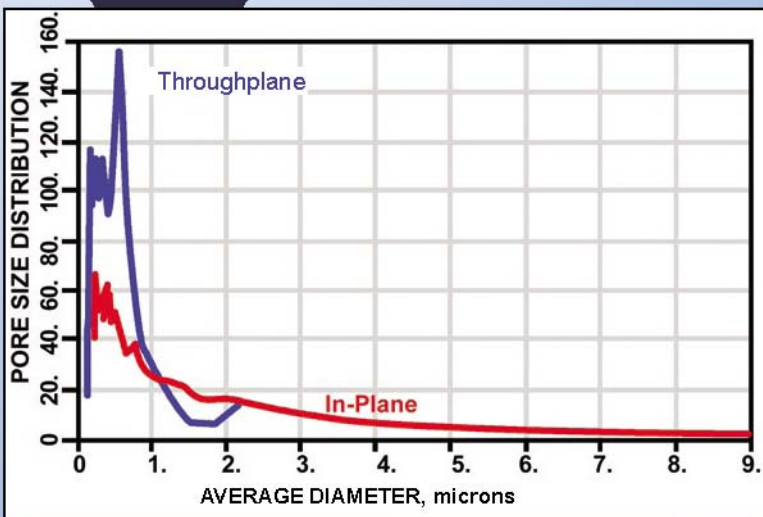
## Optional Capabilities

- Liquid permeability: Measuring liquid flow rate through the sample when pressure is applied on excess liquid on the sample. Volume of liquid measured using a penetrometer.
- Pressure Hold Test
- Hydro-head (break through pressure) test
- Integrity test
- Envelope Surface Area, average particle size and average fiber diameter obtained from gas flow rate through dry sample
- Multiple sample chamber
- Multiple test mode
- Shuffled smoothness test
- Burst pressure test
- Use of desired fluid including strong chemicals
- Elevated temperature test



## Multi-Mode Instruments

- Q.C., Clamp-On, In-Plane, and Compression modes may be combined
- In-Plane test permits measurement of pore in the x-y plane
- In-plane test permits insitu determination of pore diameter and structure of each layer of the multi-layer media



## Specifications

**Pressure Accuracy:** 0.15% of reading

**Test Pressure:** 100, 200 and 500 psi instrument versions (700, 1400, 3500 kPa instrument versions)

**Pressure and Flow Resolution:**  
1/60,00 of full scale (1 part in 60,000)

**Maximum Pore Size Detectable:** 500  $\mu\text{m}$

**Minimum Pore Sizes Detectable:**

**Flow Rates:** Up to 200 SLPM (standard liters per minute)

**Sample Size:**

Standard: 0.25" - 2.5" diameter (up to 1.5" thick).  
Standard: 5 mm - 60 mm diameter (up to 40 mm thick).

Others available

**Sample Geometry:** Sheets, Rods, Tubes, Hollow Fibers, Cartridges, Powders, etc.

Fluid	Surface Tension, dynes / cm	Diameter $\mu\text{m}$ , (100 psi Porometer)	Diameter, $\mu\text{m}$ , (200 psi Porometer)	Diameter, $\mu\text{m}$ (500 psi Porometer)
Water	72	0.30	0.15	0.06
Mineral Oil	34.7	0.14	0.07	0.03
Petroleum Distillate	30	0.12	0.06	0.03
Denatured Alcohol	22.3	0.09	0.05	0.02
Silwick	20.1	0.08	0.04	0.02
Porewick	16	0.07	0.03	0.014
Galwick	15.9	0.07	0.03	0.014

## Other Products

Average Fiber Diameter Analyzer  
Bubble Point Tester  
Capillary Flow Porometer  
Capillary Condensation Flow Porometer  
Complete Filter Cartridge Analyzer  
Clamp-On Porometer  
Compression Porometer  
Custom Porometer  
Cyclic Compression Porometer  
Envelope Surface Area Analyzer  
Filtration Media Analyzer  
High Flow Porometer  
Integrity Analyzer

In-Plane Porometer  
Microflow Porometer  
Nanopore Flow Porometer  
QC Porometer  
Diffusion Permeameter  
Gas Permeameter  
Liquid Permeameter  
Vapor Permeameter  
Water Vapor Transmission Analyzer  
Liquid Extrusion Porosimeter  
Mercury/Nonmercury Intrusion Porosimeter  
Vacuapore  
Water Intrusion Porosimeter (Aquapore)

BET Liquisorb  
BET Sorptometer  
Gas Pycnometer  
Mercury Pycnometer

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