THE PMI ADVANCED PERM POROMETER

CFP-1020-APLC-GFR

The PMI Advanced Perm Porometer is designed to measure pore size of non-wovens according to the standard ASTM F 316-03, Gurley Permeability according to standards ISO 5636-3 and 5, TAPPI-T460, Frazier Permeability according to standards IS:11056-1984, DIN 53887, ASTM D-737-96 ASTM D 3574, EN ISO 7231, BS 5636, ISO-9237/7231, JIS L 1096A, EDANA 140.1, AFNOR G07-111, TAPPI T251, GB/T 5453/13764, and Rayl Permeability according to ASTM C522-03.

PMI
Porous Materials, Inc.

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Description

The PMI Advanced Perm Porometer is capable of measuring pore throat diameter, bubble point, mean flow pore diameter, pore diameter range, and pore size distribution.

PMI Perm Porometers are used for R&D and quality control in industries worldwide such as filtration, nonwovens, pharmaceutical, biotechnology, healthcare, household, food, hygienic products, fuel cell, water purification, and battery. Samples often tested include filter media, membranes paper, powders, ceramics, battery separators and health care products.

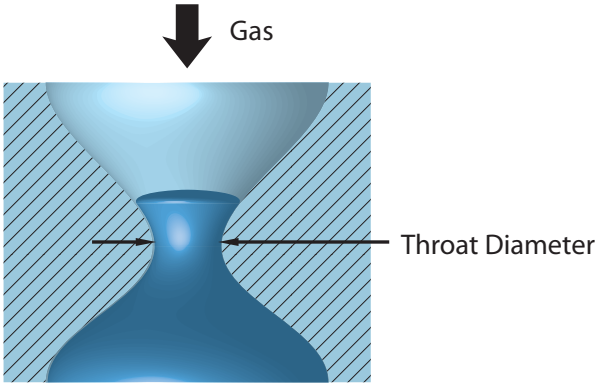

Figure 1

Typical pore analysis procedure

Principle of Porometry

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, γ is the surface tension of liquid, θ 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.

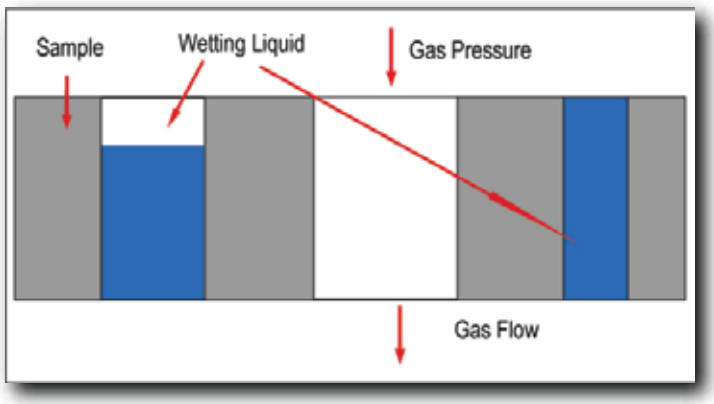

Figure 2

Basic principle behind analyzing pore structure

Principle of Gas Permeabilty

The PMI Advanced Perm Porometer can be used to determine the permeability of porous solids. A gas such as air is forced to flow through the test sample. Measurements of the steady-state flow rate and the corresponding pressure drops provide the necessary data for calculation of the permeability using Gurley, Rayl and Frazier units.

Principle of Liquid Permeability

The flow of liquid through a sample is measured by the distance a column of liquid drops in relation to time and pressure. This method gives reproducible results, even for hydrophobic materials, as pressure can be applied up to 200 psi to the liquid column to force the liquid through the sample. Very low permeability samples are tested using an accurate weighing balance to measure liquid flow rate.

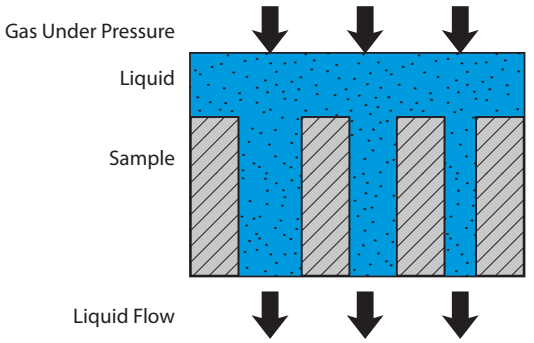

Figure 3

Principle of liquid permiability test

Application

PMI Perm Porometers yield very objective, accurate and reproducible results, considerably reduce test duration, and require minimal operator involvement. The pressure is measured close to the sample and therefore, the correction term in the differential pressure measurement is minimized. This sophisticated instrument has found applications in a wide variety of industries.

Testing Capabilities of Porometry

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

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

  fw = flow rate through wet sample

  fd = flow rate through dry sample

Testing Capabilities of Frazier, Gurley and Rayls Permeability

Frazier, Gurley and Rayls permeability is measured according to standards ISO 5636-3 and 5, TAPPI-T460, IS:11056-1984, DIN 53887, ASTM D-737-96 ASTM D 3574, EN ISO 7231, BS 5636, ISO-9237/7231, JIS L 1096A, EDANA 140.1, AFNOR, G07-111, TAPPI T251, GB/T 5453/13764, and ASTM C522-03

Optional Capabilities

- 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
- Gurley, Frazier, or Rayls permeability (special sample holders and pressure transducers for high accuracy tests)

Porometry Features

- Fully automated and computer controlled
- Testing of small samples as well as complete parts
- Ability to measure diameter of the most constricted part of a through pore (pore throat), bubble point, mean flow pore diameter, pore diameter range, and pore size distribution
- Any sample geometry (Example: sheets, rods, tubes, hollow fibers, cartridges, & powders)
- Ability to switch between two or more flow meters
- Any nonwetting liquid
- Able to measure permeability of liquids such as water and alcohol
- Tests in QC, research, or any number of user defined modes
- Based upon PLC Technology with 24 bit resolution pressure and flow sensors
- Real time graphic display
- Window based software for all control, measurement, data collection, data reduction, and report preparation

Fluid	Surface Tension dynes/cm	Diameter µm (100 psi Porometer)	Diameter µm (200 psi Porometer)	Diameter µm (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

Figure 4

Intrusion Liquid Chart

Frazier Features

- Fully automatic
- Windows-based software handles all control, measurement, data collection, and report generation; complete manual control also possible
- Comes with a PC computer equipt with real-time graphical LCD test display that depicts testing status and results throughout operation
- Non-destructive testing
- Length of test approximately 1 minute
- Wide range of acceptable sample types and sizes
- Multiple sample chambers available
- Minimal maintenance required
- Units in Frazier
- Automatic, pneumatic sample clamping
- Interchangeable test head

Gurley Features

- Fully automatic
- Windows-based software handles all control, measurement, data collection, and report generation; complete manual control also possible
- Comes with computer equipt with real-time graphical test display depicts testing status and results throughout operation
- Non-destructive testing
- Length of test approximately 1 minute
- Wide range of acceptable sample types and sizes
- Multiple sample chambers available
- Minimal maintenance required
- Units in Gurley
- Completely automated air permeability tester
- Pneumatic Clamping

Rayl Features

- Windows-based software handles all control, measurement, data collection, and report generation; complete manual control also possible
- Compatible with Windows 97 or higher
- Real-time graphical test display depicts testing status and results throughout operation
- Non-destructive testing
- Length of test approximately 1 minute
- Minimal maintenance required
- Multiple sample chambers available

Porometry Specifications*

- Pore Size Range: 0.5 - 500 microns
- Pressure Accuracy: 0.15% of reading
- Pressure Range: 0 - 20 psi
- Sample Size for Holder 1: 5-40 mm diameter / 20mm thickness
- Sample Size for Holder 2: 60mm diameter / 40mm max thickness
- Flow Meter: Maximum flow rate 200 liter/min capacity
- Flow Meter Resolution: 1 in 60,000
- Pressure & Flow Resolution: 1/60,000 of full scale (1 part in 60,000)
- Sample Geometry: Sheets, Rods, Tubes, Hollow Fibers, Cartridges, Powders

Frazier Specifications*

- Sample Size: 5 cm2 to 100 cm2 test area
- Pneumatic Clamping: (180±30)N
- Pressure Range: Up to 15" water column
- Pressurizing Gas: Clean, dry or compressed air (Or any other nonflammable and noncorrosive gas)
- Pressure controller: 0.5 ± 0.01 inch water
- Accuracy: 0.15% of reading
- Mass Flow Transducer Range: 200 LPM
- Power Requirements: 220-230V, 50Hz

Gurley Specifications*

- Air Permeance Range: 0.35µm/(Pa•s) and 15µm/(Pa•s) and 0.1 µm/(Pa•s) and 100 µm/(Pa•s)
- Sample Size: 100mm x 100mm
- Pneumatic Clamping: (180±30)N
- Pressure Range: Up to (127 ± 0.02)kPa
- Pressurizing Gas: Clean, dry or compressed air (Or any other nonflammable and noncorrosive gas)
- Pressure Transducer Range: 0 – 150 kPa
- Reservoir Volume: 10 litres
- Pressure controller: 1.47 ± 0.02 kPa
- Accuracy: 0.15% of reading
- Mass Flow Transducer Range (3 options):
  5-150 ± 2 ml/min 50-500 ± 5 ml/min 300-3000 ± 20 ml/min
- Power Requirements: 220-230V, 50Hz (others available)

Rayl Specifications*

- Permeability Range: 100 - 10,000 Mks Rayls
- Pressurizing Gas: Clean, dry or compressed air (or any other non-flammable and non corrosive gas)
- Pore Pressure: 250 psi or more
- Pressure Transducer Range: 0 - 500 PA
- Resolution: 1 -60,000
- Accuracy: 0.15% of reading
- Mass Flow Transducer Range: 10cm^3/min - 500,000 cm^3/min
- Power Requirements: 110/220 VAC, 50/60 Hz (others available)

**Other specifications for this machine are available. Specifications are subject to change without notice.*

Sales & Services

Our sales team is dedicated to helping our customers find which machine is right for their situation. We also offer custom machines for customers with unique needs. To find out what we can do for you, contact us.

We are committed to customer support including specific service products, short response times & customer specific solutions. To quickly & flexibly meet our customer's requirement, we offer a comprehensive range of services.

Customize your machine today!

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The most advanced, accurate, easy to use
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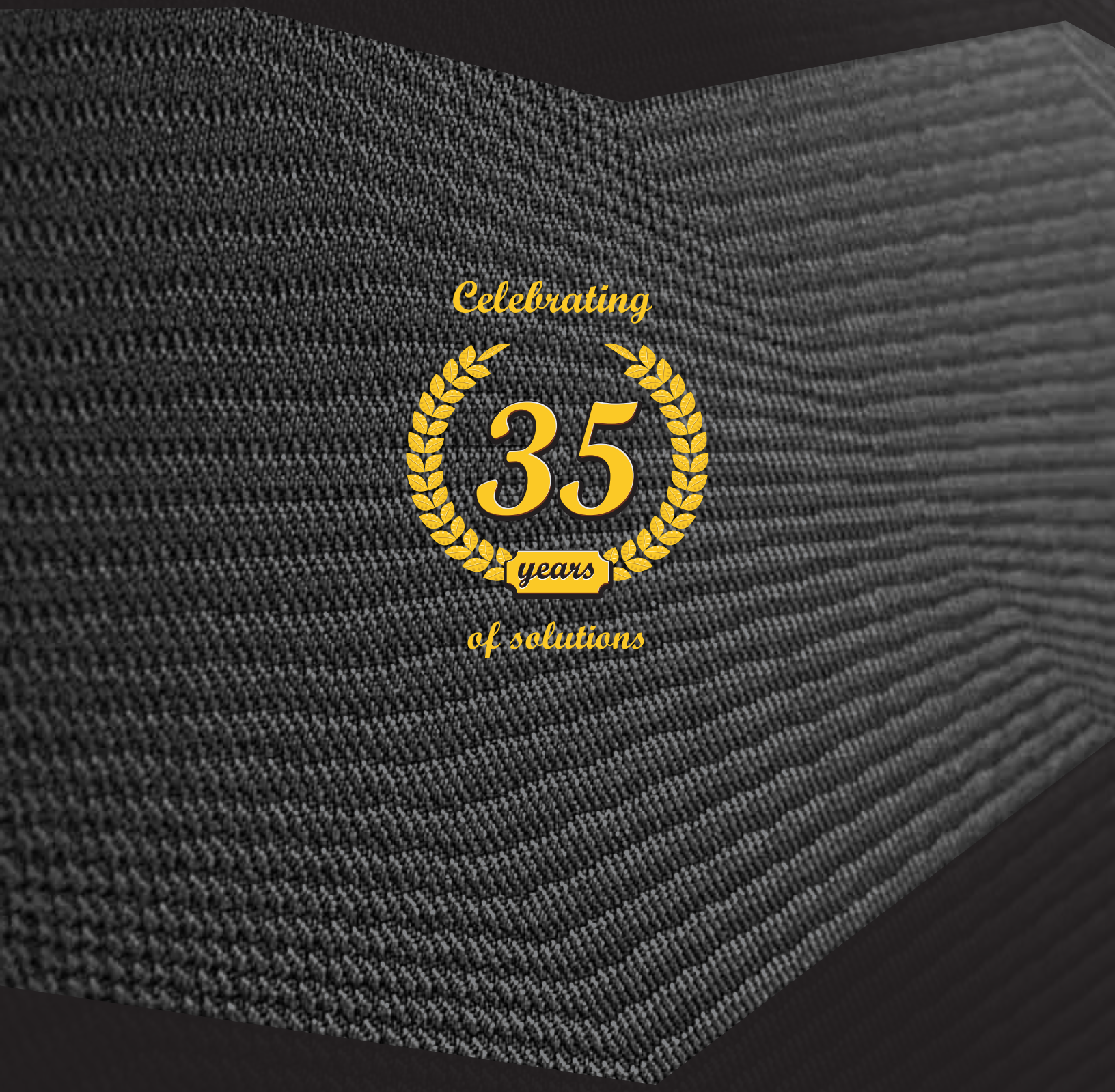

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