

# Water Vapor Transmission Analyzer

ASTM F2298-03

## Applications

The PMI Water Vapor Transmission Analyzer is capable of measuring water vapor transmission through porous media such as textiles, leathers, man made materials, membranes, nonwovens, and fabrics used in numerous high tech components and consumer products manufactured by a variety of industries. The instrument has the unique ability to measure vapor transmission rate over a wide range of humidity, temperature and pressure under gradients of humidity, temperature and pressure encountered in application environments.



## Principle

Two independent gas streams are maintained on the two sides of a sample at the desired temperature. Humidity and gas flow rates are measured. The transmission rate through the sample is computed using mass balance.

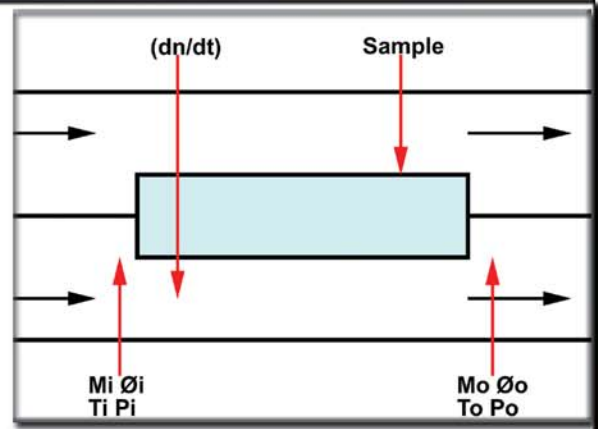
$$(dn/dt) + [(p_{e,i} \Phi_i / P_i) M_i] = [(p_{e,o} \Phi_o / P_o) M_o]$$

Where

n = moles  
t = time

$\Phi$  = humidity  
p<sub>e</sub> = equilibrium pressure

M = flow rate  
P = total pressure



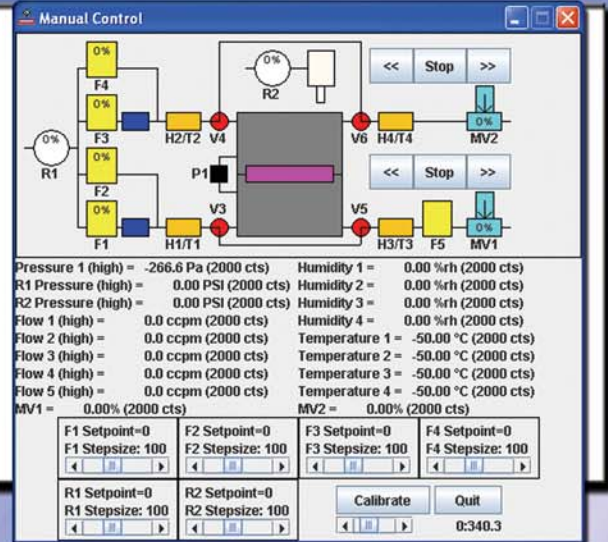
## The Instrument

The sample is enclosed in a sample chamber. A part of the gas flowing through each independent stream is allowed to go through bubblers while the other part bypasses the bubblers and mixes with the gas passing through the bubblers. For maintaining constant humidity in the inlet gas stream, the flow rate in each part of the gas stream is controlled utilizing a feedback circuit. The gas pressure is controlled by the valve at the end of each gas flow line. The valves automatically control and maintain either zero differential pressure or a finite definite pressure difference. Absolute pressure remains close to the standard pressure. The inlet and outlet flow rates and humidity are measured. The water vapor transmission rate through the sample is computed using the following relation.

$$(dn/dt) = [p_e \Phi_o - p_e \Phi_i] M_o / [1 - p_e \Phi_i]$$

## Unique Features

- ◆ Humidity on any side can be maintained between 5 and 95%
- ◆ Any desired pressure gradient can be maintained.
- ◆ Any desired test temperature can be achieved
- ◆ Simultaneous pressure and humidity gradients can be maintained
- ◆ Flat samples in a wide range of sizes can be accommodated
- ◆ Completely automated
  - ★ Test execution
  - ★ Data acquisition
  - ★ Data storage
  - ★ Data reduction



## Specifications

### Humidity ( $\phi$ ) measurement

**Range:** 5 - 95%

**Accuracy:**  $\pm 2\%$

### Humidity ( $\phi$ ) control

**Range:** 0 - 100%

**Accuracy:**  $\pm 1.5\%$  ( $\phi = 0.5$ ) -  
 $\pm 5\%$  (high & low  $\phi$ )

### Differential pressure transducers

**Range:** 4 torr (2 mm Hg)

**Accuracy:** 0.015%

### Temperature

**Range:** RT - 100 °C

**Accuracy:** 0.4 °C (low  $\phi$ ) - 0.8 °C (high  $\phi$ ) at  
100 °C

**Control:**  $\pm 2\%$

### Mass Flow Transducers

**Range:** 5 L/min

**Accuracy:** 1%

### Mass Flow Controller

**Range:** 2000 cc/min

**Accuracy:** 1%

## Other Products

- ◆ Capillary Flow, QC, In-Plane, Clamp-On, Microflow, Compression, and Cyclic Compression Porometers
- ◆ Bubble Point, Cartridge, and Integrity Testers
- ◆ Liquid Extrusion Porosimeter
- ◆ Liquid/Gas/Vapor Permeameters
- ◆ Envelope Surface Area Analyzers
- ◆ Pycnometers
- ◆ Mercury/Nonmercury Porosimeters
- ◆ BET Surface Area and Pore Analysis Sorptometers
- ◆ Testing Services and Consulting Services

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