



# AMETEK MOCON CONSULTING & TESTING SERVICES

Expert testing and consulting services for  
barrier film, material and package integrity testing

PERFORMANCE SERVICES

## Why is Permeation Testing Important?

The vast majority of materials and packages permeate at some level (e.g. gas and vapors move through them). This movement impacts the functionality of the material and the shelf-life of the product within a package. Simply put, permeation touches many facets of our life. Some examples include:

- Oxygen ingress into modified atmosphere packaging (MAP) used with foods and pharmaceuticals will react with the product and shorten its life.
- Quantifying Oxygen breathability is important for medical wound dressings (to minimize infections) and for products that require high respiration rates (e.g. produce packaging)
- Water vapor ingress can negatively affect dry products, such as food (via taste, texture and degradation reactions) and high-end electronics (OLEDs and Solar panels, where core product life and functionality are affected by minute levels of corrosion)
- Water vapor loss can impact a diluted drug product or reagents creating higher active ingredient concentrations that push the product outside of its specifications.
- Carbon dioxide loss impacts the “fizz” or carbonation and taste profile of beverages.
- Carbon dioxide ingress is important to quantify when developing barrier coatings to slow the carbonation process of concrete and extend the life of buildings and bridges.

## How Can Our Consulting & Testing Services Help You?

With over 50 years of permeation expertise, AMETEK MOCON and our Laboratory continues to lead the way with both industry recognized and custom test methods for measuring gas transmission rates through thousands of materials, whole packages and gasket & seal applications.

### Film Permeation Testing

- Simple polymers (PE, PP, PET..etc.)
- Multi-layered materials (EVOH, Nylon, scavengers and other embedded layers)
- Coatings (AlOx, SiOx, etc. for higher barrier)
- Coated paper (new compostable structures)

### Package Testing

- Pouches
- Bottles and trays
- Blister and single dose packages
- Gaskets and seals



## Common Permeation Tests

Transmission Rate Analysis	Common Test Conditions	Alternate Test Conditions
Oxygen Transmission Rate	23°C (73.4°F) and dry gasses	<b>Refrigerated:</b> 5°C with 100% RH or dry gasses <b>Room Temperature:</b> 23°C with 50% RH <b>Accelerated Temperature:</b> 40°C with 100% RH or 90% RH
Water Vapor Transmission Rate	37.8°C (100°F) with 100% RH or 90% RH	
Carbon Dioxide Transmission Rate	23°C (73.4°F) and dry gasses	

## High Quality Barrier & Package Integrity Testing

At AMETEK MOCON, we have the world's largest permeation laboratory and have worked diligently to obtain and maintain our ISO/IEC 17025:2017 accreditation. We provide reliable permeation and package testing services. We have the volume of equipment to take on large-scale permeation projects. This is key as many high-barrier samples require weeks to fully reach equilibrium.

Our Laboratory is equipped with Water Vapor Transmission Rate (WVTR/MVTR), Oxygen Transmission Rate (OTR) and Carbon Dioxide Transmission Rate (CO<sub>2</sub>TR) permeation analyzers, packaging equipment to confirm MAP effectiveness (e.g. %O<sub>2</sub>, %CO<sub>2</sub>, %CO and %RH within a packages headspace) and Seal Integrity, Burst Testing, and CO<sub>2</sub> leak detection analyzers.

Some of the common tests we offer are listed below.

### ASTM Permeation Test Methods

Test Description	Test Method	Description	Test Range	Typical Samples
Oxygen Transmission Rate (OTR)	ASTM D3985	Film and coating testing with dry gasses	0.005 to 2000 cc/(m <sup>2</sup> •day)	Food, Medical, Building Materials, Rubber & Electronics
	ASTM F1927	Film and coating testing with humidified gasses	0.005 to 2000 cc/(m <sup>2</sup> •day)	Food, Medical, Building Materials, Rubber & Electronics
	D3985 & F1927	High barrier film and package testing	0.0005 to 200 cc/(m <sup>2</sup> •day)	Electronics and Medical Devices <i>Ultra-high barriers need to perform like glass or metal</i>
	ASTM F1307	Package testing with dry or humidified gasses	0.00003 to 1 cc/(package day)	<b>Full packages and oxygen ingress including:</b> pouches, trays and lidding, bottles and closures, syringes, devices, tubing, seals, gaskets, blister packs, and single dose packaging
	ASTM F2622	Low barrier film testing	0.5 to 144,000 cc/(m <sup>2</sup> •day)	Produce packaging & highly breathable, non-porous materials
	ASTM F3136	Low barrier film or package testing	100 to 100,000+ cc/(m <sup>2</sup> •day) or 0.2 to 2,000+ cc/(package day)	Extremely high OTR measurement of perforated materials and non-hermetically sealed (leaky) packages (e.g. snap lids and screw on closures)
Water Vapor Transmission Rate (WVTR/MVTR)	ASTM F1249	Wide range of film, coatings and package component testing	0.005 to 1,000 cc/(m <sup>2</sup> •day)	Food, Medical, Building Materials, Rubber & Electronics
	ASTM F3299	Ultra-high barrier film and package testing	0.05mg to 5 g/(m <sup>2</sup> •day) Aquatran 2/3	Electronics, OLEDs, Solar Panels, Encapsulations and Medical Devices  <i>Ultra-high barriers need to perform like glass or metal</i>
			0.5mg to 5 g/(m <sup>2</sup> •day) Aquatran 1	
	ASTM D6701	Low barrier film testing	500 to 100,000 g/(m <sup>2</sup> •day)	Breathable Membranes, Diaper Products, Building Wraps
	ASTM E398	Moderate barriers	0.5 to 3000 g/(m <sup>2</sup> •day)	Food Packaging
ASTM E96	Low barrier testing	1 to 80,000 cc/(m <sup>2</sup> •day)	Used with porous samples that can't be analyzed with instrument methods – such as uncoated paper	
Carbon Dioxide Transmission Rate Testing (CO <sub>2</sub> TR)	ASTM F2476	Wide range of film and package testing	0.5 to 10,000 g/(m <sup>2</sup> •day)	Beverage, Food, Medical, Building Materials & Electronics

\* Most Common Transmission Rate Test Methods

## MAP Characterization and Package Integrity Test Offerings

The AMETEK MOCON Laboratory offers solutions beyond permeation testing that include:

- Headspace testing for MAP (O<sub>2</sub>, CO<sub>2</sub>, CO, and % RH)
- Permeability, solubility, and diffusion coefficient measurement
- High temperature and humidity testing
- Custom test method development and validation
- Burst testing for packages
- Seal integrity via pressure decay testing
- Leak detection via CO<sub>2</sub> gas loss



## Package Integrity Test Methods and Other ASTM Methods

Test Description	Test Method	Typical Samples
Headspace % O <sub>2</sub> , % CO <sub>2</sub> and CO	Dansensor Headspace Analyzer	Modified Atmosphere Packaged Samples found with Food and Pharmaceuticals
Headspace % O <sub>2</sub>	ASTM F2714 – OpTech-O <sub>2</sub> Analyzer	Very small volume packages found with Food and Pharmaceuticals
Headspace % RH Testing	AMETEK MOCON Developed Method	Food Samples, humidity sensitive electronics and combination medical devices (e.g. drug coated stents)
Burst Testing of Packages	ASTM F2054 – with Lippke Instruments	Sealed packages for Food, Electronics, Pharmaceutical and Medical Devices
Seal Integrity Testing via Pressure Decay of Packages	ASTM F1140 and ASTM 2095 with Lippke Instrument	Sealed packages for Food, Electronics, Pharmaceutical and Medical Devices

## Beyond the Lab – We have Applications Specialists and Consultants that can help you.

Our highly trained and experienced Applications Specialists can assist you with:

- Educating your personnel, researchers and engineers on theories and factors associated with permeation and testing
- Develop customized testing solutions for your specific material or package
- Develop custom Test Cartridges and Fixtures to simplify your laboratory testing
- Develop protocols and test method validations for your specific product and instrumentation
- Train your operators with these protocols

