



3-CELL GAS PERMEABILITY TESTER

3-Cell Gas Permeability Tester - ToronGPT™ 3

Three-Chamber Differential Pressure Tester for Routine Film and Package Barrier QC

The ToronGPT™ 3 is a three cell gas permeability tester that measures the gas transmission rate (GTR) of plastic films, laminated films, metal foils, and packaging materials. The system uses the vacuum differential pressure method to determine how readily oxygen, nitrogen, carbon dioxide, and other gases pass through a barrier. Three independent chambers test three specimens at once, which suits routine batch QC where labs release many samples per shift. A standard detection range starting at $0.05 \text{ cm}^3/(\text{m}^2 \cdot 24\text{h} \cdot 0.1\text{MPa})$ covers common films, laminates, and coated structures.

Operation centers on a zero-configuration workflow. The ToronGPT™ 3 starts on one click, runs the full test automatically, and stops on its own without preset parameters or operator judgment during the run. The vacuum pump also starts and stops by itself according to test state, so unattended testing stays reliable. Three selectable test modes, increment, proportional, and intelligent, let the instrument adapt to different barrier levels for a practical balance of speed and accuracy.

Circulating-water temperature control holds each chamber at a stable set point across a 5°C to 95°C span, and an optional humidity generator adds controlled relative humidity for real-service testing. Live curves for chamber temperature, test pressure, and transmission rate let operators follow each run, while traceable reference-film calibration keeps results defensible for audits. The ToronGPT™ 3 (3-Cell Gas Permeability Tester) serves packaging, film, food, pharmaceutical, and electronics labs that need dependable routine barrier data.

APPLICATIONS

3-Cell Gas Permeability Tester - ToronGPT™ 3 Applications

The ToronGPT™ 3 supports gas barrier testing across industries where controlling oxygen, moisture, and gas permeation protects product quality and shelf life.

- **Food and Beverage Packaging:** batch QC of films and laminates to confirm the oxygen and carbon dioxide barrier that protects flavor, freshness, and shelf life.
- **Flexible Packaging and Converting:** routine release testing of multilayer laminates and metallized films during production runs and incoming inspection.
- **Pharmaceutical and Medical Packaging:** barrier verification of blister films, foils, and pouches that protect moisture- and oxygen-sensitive drug products.
- **Metal Foil and Laminate Materials:** measures gas permeation through foil laminates and aluminized films used in demanding barrier packaging.
- **Plastic Film and Sheet Production:** incoming and outgoing QC of PE, PP, PET, and coated films against defined barrier targets.
- **Rubber, Tires, and Elastomers:** characterizes gas permeation through rubber sheeting and tire inner-liner compounds for material development.
- **Membrane and Materials Research:** studies permeation, diffusion, and solubility behavior of permeable membranes and polymer films.
- **Electronics and Photovoltaic Encapsulation:** barrier screening of films that shield sensitive electronic and PV assemblies from oxygen and moisture ingress.



Standards

The ToronGPT™ 3 is designed to align with internationally recognized test methods for gas transmission rate measurement by the differential pressure method.

- ASTM D1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
- ISO 15105-1 - Plastics: Film and Sheeting: Determination of Gas-Transmission Rate: Part 1: Differential-Pressure Methods
- ISO 2556 - Plastics: Determination of the Gas Transmission Rate of Films and Thin Sheets Under Atmospheric Pressure: Manometric Method
- JIS K 7126-1 - Plastics: Film and Sheeting: Determination of Gas-Transmission Rate: Part 1: Differential-Pressure Method

FEATURES

3-Cell Gas Permeability Tester - ToronGPT™ 3 Key Features

The ToronGPT™ 3 pairs hands-off automation with three-sample throughput, targeting fast and repeatable barrier data for routine quality control.

- **Vacuum Differential Pressure Method:** establishes a precise pressure gradient across the specimen for accurate gas transmission measurement on a wide range of materials.
- **Three Independent Test Chambers:** run three specimens at once, each with its own data channel and temperature sensor, so labs process more samples per shift.
- **Zero-Configuration Operation:** no test parameters to preset and no specialist judgment during the run, which lowers the training burden for new operators.
- **One-Click Automated Testing:** a single command runs the complete sequence automatically and stops on its own, cutting operator effort and test-to-test variability.

- **Automatic Vacuum Pump Control:** the pump starts and stops based on test state, supporting reliable unattended and overnight testing.
- **Multiple Test Modes:** increment, proportional, and intelligent modes adapt the measurement to different materials and barrier levels.
- **Circulating-Water Temperature Control:** hollow, water-circulated chambers hold a stable set point across a 5°C to 95°C span for repeatable, isothermal results.
- **Permeation Coefficient Analysis:** reports permeability, diffusion, and solubility coefficients alongside transmission rate for deeper material characterization.
- **Optional Humidity Control:** an add-on humidity generator applies controlled relative humidity to reproduce real service conditions during barrier testing.
- **Built-In Ambient Monitoring:** an internal temperature and humidity sensor logs room conditions with every test for better traceability.
- **Real-Time Data Curves:** on-screen plots of chamber temperature, test pressure, and transmission rate let operators judge progress and stability at a glance.
- **24-Bit Delta-Sigma Data Acquisition:** high-resolution conversion delivers clean, stable readings across the measurement range.
- **Remote Maintenance and Updates:** the embedded system supports remote diagnostics and firmware updates to reduce service downtime.
- **Traceable Reference-Film Calibration:** calibration against certified reference films keeps results defensible for QC release and certification audits.
- **Laboratory Data Management Integration:** connects to lab data management software for centralized records, review, and reporting.

THEORY & METHOD

Theory and Method

The differential pressure method, also called the manometric method, measures gas transmission by holding a controlled pressure gradient across a film. The specimen divides the test cell into an upper chamber and a lower chamber. The instrument evacuates the whole gas circuit, then admits test gas to the upper chamber at a set pressure while the lower chamber starts near vacuum. This difference in pressure becomes the driving force that pushes gas through the material.

Gas transport follows the solution-diffusion model. Molecules dissolve into the upstream face of the film, diffuse through the polymer matrix, and desorb at the downstream face. The permeability coefficient (P) equals the product of the diffusion coefficient (D) and the solubility coefficient (S), so one test cell can characterize all three properties. As gas collects in the sealed lower chamber, pressure there rises in proportion to the amount that has permeated, and a vacuum sensor tracks that rise over time.

The system computes gas transmission rate from the steady-state slope of lower-chamber pressure against time, using the known test area, chamber volume, and temperature. Film thickness and the applied pressure differential then yield the permeability coefficient, while the transient time-lag portion of the curve resolves the diffusion and solubility coefficients. Selectable increment, proportional, and intelligent test modes adjust how the instrument samples this curve, matching measurement effort to the barrier level of each material, while circulating-water temperature control keeps every chamber isothermal.

TECHNICAL SPECIFICATIONS

3-Cell Gas Permeability Tester - ToronGPT™ 3 Technical Specifications

Parameter	Specification
Measurement Range	0.05 to 190,000 cm³/(m²·24h·0.1MPa) (standard)
Resolution	0.001 cm³/(m²·24h·0.1MPa)
Test Chambers	3, independent

Parameter	Specification
Vacuum Accuracy	0.1 Pa
Temperature Range	5°C to 95°C
Temperature Accuracy	±0.1°C
Humidity Range	0% RH; 35% to 90% RH; 100% RH (optional)
Humidity Accuracy	±1% RH (optional)
Sample Thickness	≤ 3 mm
Sample Size	≥ 150 mm × 94 mm
Test Area	48 cm ²
Test Gases	O ₂ , N ₂ , CO ₂ , He, and others
Differential Pressure	-0.1 MPa to 0.1 MPa
Gas Interface	Ø8 mm
Dimensions	730 mm (L) × 510 mm (W) × 350 mm (H)
Voltage	AC 220 V, 50 Hz (110V is also available)
Net Weight	63 kg

Standard Delivery

Item	Description
Main Unit	Three-chamber gas permeability test instrument
Computer	Dedicated control PC

Item	Description
Control Software	Instrument operation and data-analysis software
Temperature Controller	Circulating-water temperature control unit
Vacuum Pump	Evacuates the gas circuit before testing
Vacuum Pump Control Module	Manages automatic vacuum pump operation
Tank Regulator	Regulates supply pressure from the test-gas cylinder
PCIe Acquisition Card	Data acquisition interface for the control PC
Communication Cable	Connects the instrument to the control PC
Sample Cutter	Prepares specimens to the required test size
Vacuum Grease	Seals the specimen at the chamber interface

Optional Accessories

Item	Description
Humidity Generator	Adds controlled relative-humidity testing
Reference Film	Certified film for traceable calibration
Vacuum Grease	Additional sealing grease for specimen mounting
Sample Cutter	Additional specimen-preparation cutter
Laboratory Data Management System	Centralized data management and reporting software



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