

SINGLE-CELL GAS PERMEABILITY TESTER



Single-Cell Gas Permeability Tester - ToronGPT™ 1

Compact Benchtop Differential Pressure Tester for Single-Sample GTR Testing

The ToronGPT™ 1 is a single 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. A single test chamber and a compact benchtop footprint make it a practical entry point for labs adding barrier testing or running lower sample volumes. A 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.

One-button operation runs each test automatically through the full sequence, so an operator loads one specimen and lets the instrument work. Embedded high-accuracy vacuum sensors and a 24-bit delta-sigma converter give the single-cell system the same measurement core found in larger multi-chamber testers. An optional temperature controller adds water-bath control across a 5°C to 95°C span when temperature-dependent testing is required.

The ToronGPT™ 1 reports permeability, diffusion, and solubility coefficients alongside transmission rate, and live data curves let operators follow each run. Traceable reference-film calibration keeps results defensible for QC and certification work. The ToronGPT™ 1 (Single-Cell Gas Permeability Tester) suits packaging, film, food, pharmaceutical, and academic labs that need reliable barrier data at a benchtop scale.

APPLICATIONS

Single-Cell Gas Permeability Tester - ToronGPT™ 1 Applications

The ToronGPT™ 1 supports single-sample gas barrier testing across industries where oxygen, moisture, and gas permeation affect product quality and shelf life.

- **Entry-Level and Low-Volume QC:** a starting point for labs adding gas barrier testing or running modest daily sample counts on a compact benchtop.
- **Food and Beverage Packaging:** confirms the oxygen and carbon dioxide barrier of films and laminates that protect flavor, freshness, and shelf life.
- **Pharmaceutical and Medical Packaging:** barrier verification of blister films, foils, and pouches that protect moisture- and oxygen-sensitive drug products.
- **Plastic Film and Sheet Production:** incoming and outgoing QC of PE, PP, PET, and coated films against defined barrier targets.
- **Metal Foil and Laminate Materials:** measures gas permeation through foil laminates and aluminized films used in barrier packaging.
- **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.
- **Universities and Teaching Labs:** a manageable single-cell platform for training students on gas transmission rate measurement and barrier science.



Standards

The ToronGPT™ 1 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

Single-Cell Gas Permeability Tester - ToronGPT™ 1 Key Features

The ToronGPT™ 1 delivers the core differential pressure measurement in a compact, single-chamber package suited to focused testing and tighter budgets.

- **Vacuum Differential Pressure Method:** establishes a precise pressure gradient across the specimen for accurate gas transmission measurement.
- **Single-Chamber Design:** focuses the full measurement chain on one specimen, keeping the instrument compact and straightforward to operate.
- **Compact Benchtop Footprint:** a small, 28 kg unit fits limited bench space in QC, R&D, and teaching labs.
- **One-Button Automated Testing:** a single command runs the complete test sequence automatically, reducing operator effort and variability.

- **Embedded High-Accuracy Vacuum Sensor:** tracks lower-chamber pressure to 0.1 Pa for reliable and stable transmission calculations.
- **24-Bit Delta-Sigma Data Acquisition:** high-resolution conversion delivers the same measurement core used in larger multi-chamber systems.
- **Integrated Chamber Temperature Sensing:** a built-in sensor monitors chamber temperature throughout each test.
- **Optional Water-Bath Temperature Control:** an add-on temperature controller holds the chamber at a set point across a 5°C to 95°C span.
- **Permeation Coefficient Analysis:** reports permeability, diffusion, and solubility coefficients alongside transmission rate for deeper material characterization.
- **Configurable Differential Pressure:** standard operation to 0.1 MPa, with optional 1.0 MPa and 4.0 MPa ranges for specialized high-pressure permeation studies.
- **Multi-Gas Capability:** tests oxygen, nitrogen, carbon dioxide, helium, and other gases, with flammable or toxic gas configurations available on request.
- **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 pressure and temperature let operators judge test progress and stability at a glance.
- **Traceable Reference-Film Calibration:** calibration against certified reference films keeps results defensible for QC release and certification audits.
- **Multiple Test Modes:** selectable modes adapt the instrument to different materials and gases.
- **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 the 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 high-accuracy 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. A single high-resolution measurement chain handles one specimen at a time, and an optional temperature controller holds the chamber isothermal when the test method calls for a fixed temperature.

TECHNICAL SPECIFICATIONS

Single-Cell Gas Permeability Tester - ToronGPT™ 1 Technical Specifications

Parameter	Specification
Measurement Range	0.05 to 160,000 cm ³ /(m ² ·24h·0.1MPa) (standard)
Resolution	0.001 cm ³ /(m ² ·24h·0.1MPa)
Test Chambers	1 (single specimen)

Parameter	Specification
Vacuum Accuracy	0.1 Pa
Temperature Range	5°C to 95°C (with temperature controller)
Temperature Accuracy	±0.1°C
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 (flammable or toxic gases such as H ₂ , CH ₄ , H ₂ S, C ₂ H ₂ , C ₂ H ₄ available on request and must be specified in advance)
Differential Pressure	-0.1 MPa to 0.1 MPa (standard); 1.0 MPa, 4.0 MPa (optional)
Gas Interface	Ø8 mm
Dimensions	330 mm (L) × 600 mm (W) × 330 mm (H)
Voltage	AC 220 V, 50 Hz (110V is also available)
Net Weight	28 kg

Standard Delivery

Item	Description
Main Unit	Single-chamber gas permeability test instrument
Computer	Dedicated control PC
Control Software	Instrument operation and data-analysis software

Item	Description
Vacuum Pump	Evacuates the gas circuit before testing
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
Temperature Controller	Adds water-bath temperature control across a 5°C to 95°C span
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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