

ELECTROLYTIC WATER VAPOR TRANSMISSION RATE TESTER (3-CELL)



Electrolytic Water Vapor Transmission Rate Tester (3-Cell) - ToronWVTR™ E3

Three-Chamber Coulometric Electrolytic Sensor WVTR Analyzer for Ultra-High-Barrier Films

The ToronWVTR™ E3 is a 3-cell electrolytic WVTR tester that measures the water vapor transmission rate of flexible films, sheeting, and finished packages. The instrument uses the electrolytic sensor method, a coulometric technique that electrolyzes every permeated water molecule for an absolute reading. Three chambers test three specimens at once, and a 0.001 g/m²·24h detection floor, the lowest in the range, resolves ultra-high-barrier foils and encapsulation films. Built around ISO 15106-3 and DIN 53122-2, it serves high-barrier packaging, electronics, and materials labs.

The ToronWVTR™ E3 tests both flat films and, with optional fixtures, finished packages, so one instrument covers material screening and package QC at higher throughput. Water-bath temperature control holds all three chambers at a set point across a 5°C to 95°C range, and controlled relative humidity reproduces real storage conditions. High-purity nitrogen carries permeated moisture to the sensors, and digital carrier-flow control keeps each sweep stable.

One-button operation runs each test automatically, and live data curves let operators follow water vapor, temperature, and humidity in real time. Traceable reference-film calibration keeps results defensible for audits, and overload protection guards the pressure, moisture, and temperature circuits. The ToronWVTR™ E3 (3-Cell Electrolytic Water Vapor Transmission Rate Tester) suits ultra-high-barrier film, electronics, solar, and pharmaceutical labs that test several samples at a time.

APPLICATIONS

Electrolytic Water Vapor Transmission Rate Tester (3-Cell) - ToronWVTR™ E3 Applications

The ToronWVTR™ E3 suits multi-sample moisture barrier testing where transmission rates are extremely low and the highest sensitivity is required.

- **Ultra-High-Barrier Films:** measures the extremely low water vapor transmission of metallized, coated, and multilayer barrier films across several samples per run.
- **Electronic Packaging and Encapsulation:** screens barrier films that protect moisture-sensitive electronic and OLED display components.
- **Photovoltaic and Solar Films:** tests backsheets and encapsulation films that shield solar cells from moisture ingress.
- **High-Barrier Flexible Packaging:** qualifies foils, aluminized films, and coated laminates for demanding moisture-barrier applications.
- **Pharmaceutical and Medical Packaging:** verifies the moisture barrier of high-barrier blister foils and pouches for highly moisture-sensitive drugs.
- **Vacuum-Deposited and Coated Barriers:** evaluates SiOx, AlOx, and other thin-film coatings where transmission is very low.
- **Finished Package Testing:** measures whole-package WVTR for pouches, bottles, and trays with optional package fixtures.
- **Barrier Materials R&D:** compares ultra-high-barrier candidates side by side during development.



Standards

The ToronWVTR™ E3 is designed to align with internationally recognized electrolytic-sensor test methods for water vapor transmission rate measurement.

- ISO 15106-3 - Plastics: Film and Sheeting: Determination of Water Vapour Transmission Rate: Part 3: Electrolytic Detection Sensor Method
- DIN 53122-2 - Testing of Plastics and Elastomer Films, Paper, Board, and Other Sheet Materials: Determination of Water Vapour Transmission Rate: Part 2: Electrolysis Method

FEATURES

Electrolytic Water Vapor Transmission Rate Tester (3-Cell) - ToronWVTR™ E3 Key Features

The ToronWVTR™ E3 combines the most sensitive coulometric sensor in the range with three-chamber throughput.

- **Electrolytic Sensor Method:** a phosphorus-pentoxide coulometric cell electrolyzes every permeated water molecule, giving an absolute WVTR measurement grounded in Faraday's law.
- **Three Independent Test Chambers:** three specimens run at once, each with its own sensor and result, raising throughput for ultra-high-barrier QC and R&D.
- **Ultra-Low Detection Floor:** reads down to 0.001 g/m²·24h, the most sensitive method in the range for ultra-high-barrier foils and encapsulation films.
- **Film and Package Testing:** tests flat films and, with optional fixtures, finished packages such as pouches and bottles.
- **Water-Bath Temperature Control:** holds all three chambers at a set point across a 5°C to 95°C range for standardized, isothermal testing.

- **Controlled Relative Humidity Testing:** conditions the gas streams to a set RH so results reflect real storage conditions for moisture-sensitive barriers.
- **Digital Carrier-Flow Control:** adjustable nitrogen sweep keeps carrier flow stable and repeatable across each cell.
- **24-Bit Delta-Sigma Data Acquisition:** high-resolution conversion resolves the very low signals produced by ultra-high-barrier films.
- **One-Button Automated Testing:** a single command runs the complete sequence automatically, reducing operator effort and variability.
- **Overload Protection:** pressure, moisture-sensor, and temperature protection circuits guard the instrument during unattended runs.
- **Independent Temperature Sensing per Chamber:** each of the three chambers carries its own temperature sensor for accurate, independent control.
- **Built-In Ambient Monitoring:** an internal temperature and humidity sensor logs room conditions with every test for better traceability.
- **Multiple Test Modes:** selectable modes adapt the instrument to different materials and barrier levels.
- **Real-Time Data Curves:** on-screen plots of water vapor, temperature, and humidity let operators judge test progress and stability.
- **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 electrolytic sensor method measures water vapor transmission by capturing and electrolyzing the moisture that crosses a film. Within each cell, the specimen separates the chamber into two sides. A humid nitrogen stream at a set relative humidity flows over the upstream face, while dry nitrogen sweeps the downstream face. The humidity gradient across the film drives water vapor toward the dry side.

The dry carrier gas delivers the permeated water vapor to an electrolytic cell coated with a hygroscopic phosphorus-pentoxide film. The coating absorbs every water molecule, and an applied voltage electrolyzes it into hydrogen and oxygen. Each water molecule contributes a fixed quantity of electrical charge, so the electrolysis current reads out the water vapor flux directly, an absolute measurement grounded in Faraday's law.

The system computes WVTR for each specimen from the steady-state electrolysis current, the carrier flow, and the test area, or the whole package for finished-package testing. Three cells run in parallel with independent results, so a single loading yields three WVTR values. Because it counts water molecules, the method reaches a very low detection floor of 0.001 g/m²·24h, which suits ultra-high-barrier foils, encapsulation films, and solar backsheets.

TECHNICAL SPECIFICATIONS

Electrolytic Water Vapor Transmission Rate Tester (3-Cell) - ToronWVTR™
E3 Technical Specifications

Parameter	Specification
Film Test Range (Standard)	0.001 to 52 g/m ² ·24h
Film Test Range (Optional)	0.01 to 1,100 g/m ² ·24h
Film Resolution	0.001 g/m ² ·24h

Parameter	Specification
Package Test Range	0.0001 to 0.5 g/pkg·d (optional)
Package Resolution	0.00001 g/pkg·d
Specimen Amount	3, independent
Temperature Range	5°C to 95°C
Temperature Accuracy	±0.1°C
Humidity Range	0% RH; 35% to 90% RH; 100% RH (standard condition 90% RH)
Humidity Accuracy	±1% RH
Test Area	50 cm ²
Specimen Size (Film)	≥ 150 mm × 94 mm; thickness < 3 mm
Specimen Size (Package)	Max Ø120 mm × 400 mm
Carrier Gas	99.999% Nitrogen
Carrier Flow	0 to 200 ml/min
Gas Interface	1/8 inch
Voltage	AC 220 V, 50 Hz (110V is also available)
Dimensions	730 mm (L) × 590 mm (W) × 350 mm (H)
Net Weight	56 kg

Standard Delivery

Item	Description
Main Unit	Three-chamber electrolytic WVTR test instrument
Computer	Dedicated control PC
Control Software	Instrument operation and data-analysis software
Temperature Controller	Water-bath temperature control unit
Tank Regulator	Regulates carrier gas supply pressure
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
Package Fixtures	Adapters for testing finished packages such as pouches and bottles
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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