



Gas Transmission Rates or Permeability  
Analysis of plastic products and packaging materials  
Tensile, Tear and other Mechanical Properties  
Physical Properties, Thermal Analysis and other tests

[www.gunnlab.com.au](http://www.gunnlab.com.au)

# Gas Transmission or Permeability Tests

Test samples can be films, sheeting, bottles, pouches, taps, whole packages up to about three litres in volume and others.

## *Oxygen Transmission Rate (OTR)*

OTR is measured using four computer controlled Mocon Ox-Tran instruments. Oxygen gas is passed over one side of the sample, while nitrogen flows over the other side out to an oxygen-sensitive detector. Oxygen permeating through the sample will appear in the nitrogen stream and be measured.

ASTM methods: F1927, D3985 or F1307 Usual units:  $\text{cm}^3/\text{m}^2 \cdot \text{day}$ .

Test temperature and humidity vary to suit end-use application.

Common conditions are 23°C, 0% RH (dry), or 75% RH.

## *Water Vapour Transmission Rate (WVTR/MVTR)*

WVTR is measured using computer controlled Mocon Permatran instruments.

Water vapour transmitted through the sample is measured by a modulated infra-red detector.

ASTM method: F1249 Usual units:  $\text{g}/\text{m}^2 \cdot \text{day}$ .

Test temperature and humidity vary to suit end-use application.

Common conditions for films are 38°C, 90% RH, or 100% RH.

Common conditions for whole packages are 23°C, 100% RH.

## *Headspace % Oxygen*

% O<sub>2</sub> is measured using a Mocon Pac-Check instrument.

Samples can be whole packages, bottles, sachets, pouches etc.

# Analysis of Structure and Materials

Materials analysis is done using various techniques, including Fourier-Transform Infra-Red Spectroscopy (Transmission and ATR), Differential Scanning Calorimetry, chemical tests, microscopy and other methods.

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*For most plastic items, we can help answer questions such as:*

What materials were used in manufacturing?

What is the structure? Are there layers?  
(e.g. lamination, co-extrusion, or coatings)

How thick are these layers?

How much of a specific additive is in  
the material mix?

What is the cause of inconsistent  
batch-to-batch performance of the product?



*Please consult us to discuss your requirements,  
to ensure we look for the most important points  
that you need to know.*

# Mechanical Properties of Plastics

Test Samples can be films, thin sheeting etc.

Load: up to 2000N (200kg).



## Tensile tests, ASTM D882

Strips of film are clamped in the jaws of an Instron universal tester and stretched at a constant speed until they break. Separate tests are done in the film's machine direction and transverse direction. The force and extension are graphed and a number of properties calculated, including strength, elongation, yield point, elastic modulus, break energy (toughness) etc.



## Tear Resistance (trouser tear) tests, ASTM D1938

Rectangular strips of film 25mm wide are pre-slit to resemble a pair of trousers. The "legs" are clamped in the jaws of a universal tester and pulled apart, so that the sample tears in the line started by the slit.

The test result is the maximum force registered while tearing.

Separate tests are done in the film's machine and transverse directions.



## Puncture Resistance tests, ASTM D5748

The film is held in a clamp with a 100mm diameter opening. A probe (attached to the load cell of a universal tester used in compression mode) is driven into the film until it ruptures. The probe tip can be 19mm (standard), 12.7mm (simulates fingers), 1mm (simulates semi-sharp objects) or other sizes. Puncture force, energy and stretch are recorded.



## Impact Resistance (Dart Drop) tests, ASTM D1709

The film is held in a clamp with a 127mm diameter opening. A dart with a rounded tip of 38mm diameter is loaded with weights and dropped onto the clamped film. Many drops are done, each on a fresh film area, with the dart weight increased or decreased each time according to whether or not the film ruptures. We calculate the Wf result, the theoretical dart weight at which exactly 50% of the drops would result in film rupture.

## Seal Strength Tests, ASTM F88

The strength of heat seals, including peel force of peelable seals and heat sealability range.

## Bond Strength or Ply Adhesion, ASTM F904

The strength of the bond between the layers of laminated films.

## Other Mechanical and Physical tests

Specialised modulus tests, package opening force, top load crushing force and many other tests are available. We can use the ASTM Standards library and confirm our capability against your needs.

# Miscellaneous Tests

Test Samples can be films, sheets, raw material granules, plastic pipes, industrial or consumer products, cable insulation etc.

## Melt Flow Index (MFI) or Melt Flow Rate, ASTM D1238

Measures the viscosity, or rate of extrusion, of molten plastic. This gives a relative indication of molecular chain length.

## Coefficient of Friction (COF) or Slip, ASTM D1894

## Thermal Properties

Differential Scanning Calorimetry (DSC) scans measure melting point/range and heat of fusion (the heat energy required to melt the polymer). In many cases we can also measure Glass transition temperature (T<sub>g</sub>) and compare relative Crystallinity.

## Thermogravimetric Analysis (TGA)

## UV-Visible Light Transmission

## Density of Plastics, ASTM D792

## Oxidative Induction Test (OIT) ASTM E1356, ISO-11357-6

Antioxidant Function tests how well a plastic is protected from oxidation. It can show if the antioxidant in the plastic has been “used up” by excessive processing, weathering etc.

**Microscopy and Digital Photomicrography**  
Microscopic examination and photography of foreign objects etc.

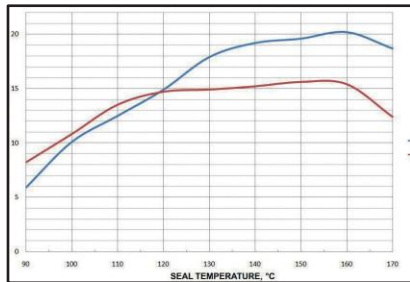
## Bag Tests

A range of tests from NZS 7603, including drop tests.

# 30 years of testing for the Plastics, Packaging and related industries

We serve clients across the world; from a wide range of industries including manufacturers, importers, local government, laboratories and research institutes.

**GunnLab focuses primarily on providing tests commonly requested by industry, in a timeframe that industry needs.**



## *For suppliers of plastic products or packaging*

- Confidential specialised testing for product development and quality assurance
- Competitive analysis
- Investigation of product failures, raw materials problems etc.

## *For users of plastic products or packaging*

- Testing for compliance to specifications, comparative performance of packaging from different suppliers
- Objective analysis to determine if there are differences between batches of packaging materials supplied to you
- Identification of plastic foreign objects found in foods, analysis of failed packs, leakages and more.

# Guidelines for sample delivery

All samples should be sent to 102 Bluff Road, Black Rock, VIC 3193.  
Please provide a track-and-trace number to [mawera@gunnlab.com.au](mailto:mawera@gunnlab.com.au).  
This helps us begin your testing as soon as possible.

## *General Recommendations*

*Try to avoid excessive creasing, damage, contamination or other imperfections, unless specifically replicating a 'real world' situation.*

Flexible films: roll loosely and place inside a cardboard tube. Alternatively, fold the sample to A4 size, and place flat rigid cardboard each side before inserting into a large envelope. If possible, include the entire width of film samples.

Sheets: protect the sample with rigid cardboard each side and place in a large envelope.  
Rigid form samples: wrap each item in bubble wrap or soft paper, then place inside a cardboard box or carton making sure there is ample protection to prevent damage between specimens in the carton.

## *Preferred Sample Size Requirements*

*For each test requested we typically need around:*

Permeation: A4 size

MFI: 6 to 10 grams

Dart Impact resistance: Area 0.5m<sup>2</sup> (minimum 150mm wide)

Puncture Resistance: Area 0.1m<sup>2</sup> (minimum 120mm wide)

Pack Integrity, Seal and Leak tests please send whole packs.

*Please consult with us if you only have smaller samples available.  
We may be able to work with less than the suggested minimum, but  
in some cases accuracy may be reduced or costs increased.*

*Turn around time is typically 5-10 working days of receiving samples.  
We can usually respond to requests for extra urgency when required.  
Given advance notice, we aim to accomodate your critical deadlines.*

## *Independent plastics testing for industry*

Private ownership underpins our independent status. This ensures your tests are conducted without being influenced by, or disclosed to others in the industry.

GunnLab Plastics Testing Laboratory has been operated by the Gunn family since 1995. Our consulting approach to customer service means you talk directly to the people you need.

Bruce Gunn is a qualified industrial/analytical chemist with a wealth of experience in manufacturing plants and research organisations. He has worked for thirty years in charge of laboratories serving the plastics and packaging industries.

Mawera Gunn holds a Master of Business Administration with extensive management and project experience. She manages test scheduling, business administration, supports operations and further improvement projects.

Our memberships and affiliations include ASTM, Society of Plastics Engineers, and the Australian Institute of Packaging.

**Bruce Gunn**

*Managing Director*

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