

Introduction

Transparency

The appearance of a transparent product is defined by its application. Packaging film used in the food industry should be very clear and transparent, while film for grocery bags should be translucent and diffuse the light. Therefore, different raw materials are selected and processed under certain conditions.

The absorption and scattering behavior of the transparent specimen will determine how much light will pass through and how objects will appear through the transparent product.

Total Transmittance

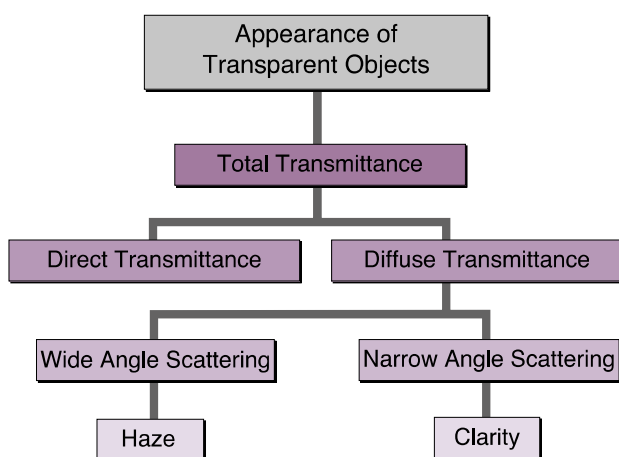
Total transmittance is the ratio of transmitted light to the incident light. It is influenced by the absorption and reflection properties, example:

Incident light	100 %
– Absorption	-1 %
– Reflection	-5 %
Total Transmittance	= 94 %

The totally transmitted light consists of the directly transmitted and the diffused components. Depending on the angular distribution of the diffused portion, a transparent plastic will appear differently.

Visual perception can clearly differentiate two phenomena:

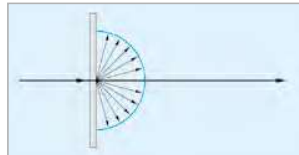
Wide angle and narrow angle scattering.



TRANSPARENCY

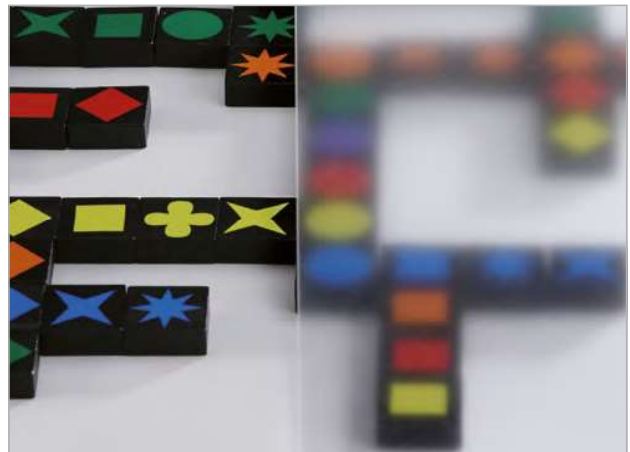
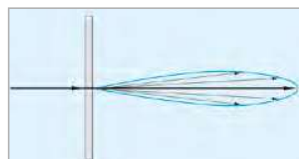
Haze: Wide Angle Scattering

Light is diffused in all directions causing a loss of contrast. ASTM D 1003 defines haze as that percentage of light which in passing through deviates from the incident beam greater than 2.5 degrees on the average.



Clarity: Narrow Angle Scattering

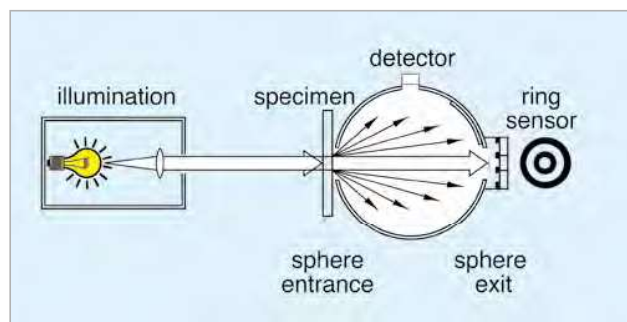
Light is diffused in a small cone with high concentration. This effect describes how well very fine details can be seen through the specimen. The see-through quality needs to be determined in an angle range smaller than 2.5 degrees.



Objective Measurement of Transparency

Measurement and analysis of haze and clarity guarantee a uniform and consistent product quality and help analyze influencing process parameters and material properties, e.g. cooling rate or compatibility of raw materials.

The figure on the right hand side shows the measurement principle of the haze meter: A light beam strikes the specimen and enters an integrating sphere. The sphere's interior surface is coated uniformly with a matte white material to allow diffusion. A detector in the sphere measures total transmittance and transmission haze. A ring sensor mounted at the exit port of the sphere detects narrow angle scattered light (clarity).



Standard Methods

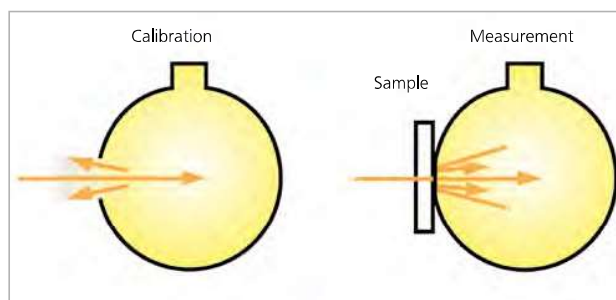
The measurement of Total Transmittance and Transmission Haze is described in international standards. Two different test methods are specified:

- ISO 13468 Compensation method
- ASTM D1003 Non-compensated method

The compensation method takes the light reflected on the sample surface into account. Differences between the two methods can be approximately 2 % Total Transmittance on clear, glossy samples.

ASTM D 1003

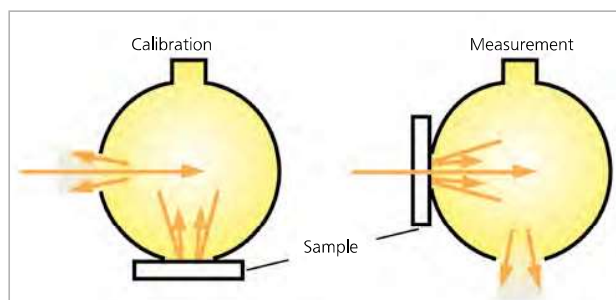
Measurement conditions are different during calibration and actual measurement. During calibration, part of the light escapes through the open entrance port of the hazemeter. While taking a measurement, the entrance port is covered with the sample. Thus, the amount of light in the sphere is increased by the light reflected at the sample surface.



No compensation: Different Sphere Efficiency

ISO 13468

Measurement conditions are kept equal during calibration and measurement due to an additional opening in the sphere. During calibration the sample is placed at the compensation port. For the actual measurement, the sample is changed to the entrance port. Thus, the so-called sphere efficiency is independent of the reflection properties of the sample.



Compensation Port: Same Sphere Efficiency

Two Standard Methods in one Unit

The haze-gard i objectively measures Total Transmittance and Haze according to the ASTM and ISO standard methods. The new optical design allows simultaneous measurement without placing the sample to a separate compensation port.



haze-gard i

The objective standard for a clear view

Transparent products can have a milky or fuzzy appearance dependent on their light scattering behavior. The haze-gard i quantifies the visual perception with objective measurement criteria:

- Total transmittance
- Transmission haze
- Clarity

haze-gard i controls complete transparency by taking only one reading.



Global communication

Haze and transmittance control according to international standard methods with one unit:

- ASTM D1003 - illuminants C and A
Non-compensated method
- ISO 13468 - illuminant D65
Compensated method

haze-gard i displays all results simultaneously - well prepared for any customer specification.

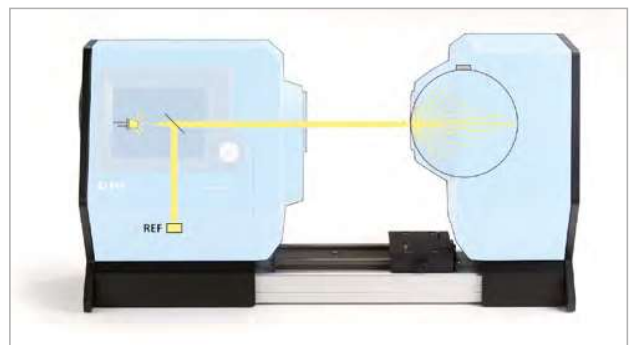


Reliable and Precise

With state-of-the-art optics and LED technology the haze-gard i delivers an unprecedented performance:

- Reference beam, self-diagnosis and enclosed optics
- LED light source assures long-term stable results for many years: 10 year warranty on the lamp life!
- Automatic, long-term calibration - operator friendly and safe

Superior repeatability and inter-instrument agreement are guaranteed.



Smart and Fast

The new touch display is designed to be intuitive and easy to use for any task:

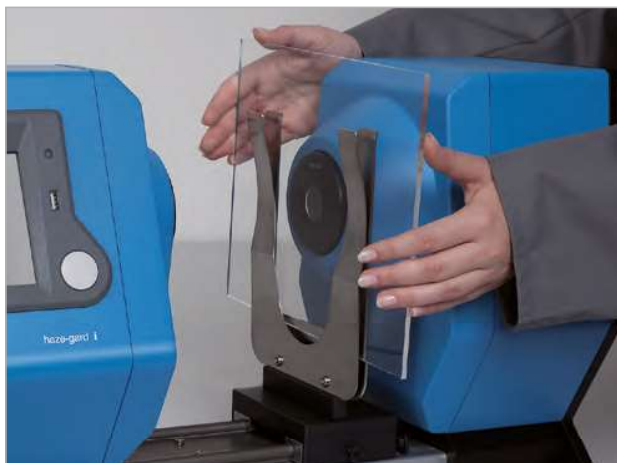
- Large touch display in color
- Symbols to select a menu function
- Dedicated measurement button
- Foot switch allows hands-free operation



Open and Flexible

The open measurement compartment let's you work freely to analyze any sample size:

- Open design for small and large specimens
- Fast change and positioning of samples
- No influence of ambient light
- Versatile sample holder for films and sheets
- Sample holders for taber abrasion test and cuvettes for liquids optional
- Customized sample holders can be easily attached



Horizontal or vertical set-up

Sample handling in any position is convenient and allows you highest flexibility.



Onboard analysis

Measurement data can be analyzed and saved in projects directly in the haze-gard i for efficient work management:

- Large instrument memory (5000 readings)
- Complete statistics with averaging, min / max, standard deviation
- Limit input for different product specifications with colorful Pass/Fail analysis



Professional connection

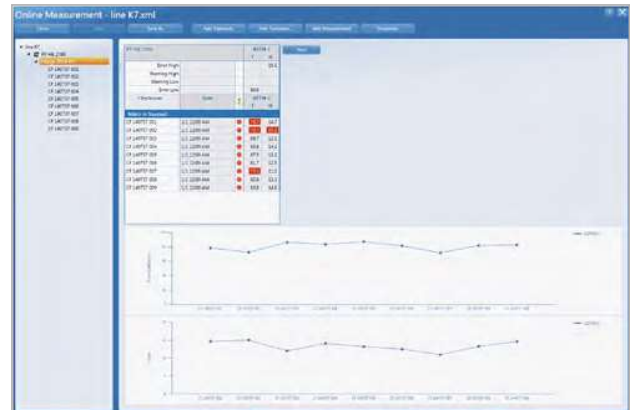
Data transfer can be performed in all sorts of ways to support you in routine lab work:

- Direct data transfer via USB-port to PC
- Direct LAN connection to your network for further analysis in Laboratory Information Management Systems (LIMS)
- Save data on a USB-stick

smart-lab haze – data analysis software

Whatever the task, smart-lab haze will do it for you. From simple data tables of single test series to trend reports over time – anything is possible.

- Define your product specifications in standard management by setting up product groups with Pass/Fail limits
- Measure your products online and get instant QC reports displayed: Data table with statistic and line graph including Pass/Fail coloring
- Manage your lab work in projects to show production process stability using trend reports
- Transfer product specs and projects to haze-gard i and vice versa for daily work management





Standards

ASTM	D 1003, D 1044
ISO	13468, 14782

Technical Specifications

Illuminants	CIE-C, CIE-A (ASTM D1003) CIE-D65 (ISO 13468, ISO 14782)
Spectral Response	CIE luminosity function y
Geometry	0° / diffuse
Measurement Area	ø 18 mm (0.7 in)
Sample Port	ø 25.4 mm (1.0 in)
Measurement Range	0 - 100 %
Repeatability	± 0.1 units (standard deviation)
Reproducibility	± 0.4 units (standard deviation)
Memory	5000 readings
Interface	LAN, USB 2.0, additional front USB-port for memory stick
Power Supply	115 V / 230 V self adapting
Operating Temperature	+10 to 40 °C (+50 to 104 °F)
Storage Temperature	0 to 50 °C (+32 to 122 °F)
Dimensions	62 x 33 x 22 cm (24 x 13 x 9 in)
Weight	18 kg (40 lbs)



Ordering Information

Cat. No.	Description
4775	haze-gard i

Comes complete with:

Hazemeter
Guide carriage for sample holders
Clarity calibration standard
Traceable certificate
Foot switch and power cable
USB-cable and LAN-cable
Software for download:
smart-lab haze with 2 Licenses
Operating manual
Training

System requirements:

Operating system: Windows 7 SP1, 8.1 or 10
Microsoft® .NET Framework 4.5.2
Hardware: Core 2 Duo, 2.5 GHz, i7 recommended, or equivalent
Memory: 4 GB RAM, 8 GB recommended
Hard-disk capacity: 2 GB during installation
Monitor resolution: 1280 x 1024 pixel or higher
Interface: free USB-port or network access

Training

BYK-Gardner offers you more than just an instrument. We train you in the operation of the haze-gard i and data analysis. A half-day training course for haze-gard i operation and smart-lab haze software is included.

Versatile sample holders for specific needs



Sample holder for films and sheets. The precision guide carriage allows easy replacement of different holders.



Special holder for very thin films.



Ordering Information

Cat. No.	Description
4788	Sample holder, for 4775
4784	Thin Film Holder, for 4775
4785	Taber Abrasion Holder, for 4775
4786	Cuvette Table, for 4775
6180	Cuvette for Liquids, 2.5 mm
6182	Cuvette for Liquids, 5 mm
6183	Cuvette for Liquids, 10 mm
6189	Cuvette for Liquids, 20 mm
4865	BYKWARE smart-lab haze

Accessories

For films and sheets
Special holder for very thin films
For evaluation of abrasion resistance with the hazemeter
For measurement of liquids
Path length 2.5 mm, edge length 50 mm
Path length 5.0 mm, edge length 50 mm
Path length 10 mm, edge length 50 mm
Path length 20 mm, edge length 50 mm
Software for professional analysis and documentation



The measurement of haze is used to determine abrasion resistance of transparent materials. The haze-gard i Abrasion Holder facilitates positioning of the abraded area in the measurement beam.



Liquids are best measured using cuvettes and the cuvette table.



Ordering Information

Cat. No.	Description
4776	Clarity Calibration Standard, for 4775
4777	Clarity Reference Standard, for 4775
4790	Haze Standard 1, for 4775
4791	Haze Standard 5, for 4775
4792	Haze Standard 10, for 4775
4793	Haze Standard 20, for 4775
4794	Haze Standard 30, for 4775
4795	Haze Standard Set, for 4775
4778	Transmittance Standard 10, for 4775
4779	Transmittance Standard 30, for 4775
4780	Transmittance Standard 50, for 4775
4781	Transmittance Standard 70, for 4775
4782	Transmittance Standard 90, for 4775
4783	Transmittance Standard Set, for 4775

Accessories

Replacement Standard for clarity, certificate included
Test standard for checking purposes, certificate included
Approx. 1% haze, for checking purposes, certificate included
Approx. 5% haze, for checking purposes, certificate included
Approx. 10% haze, for checking purposes, certificate included
Approx. 20% haze, for checking purposes, certificate included
Approx. 30% haze, for checking purposes, certificate included
Set of 5 pieces in hard box, certificate included
Approx. 10% total transmittance, for checking purposes, certificate included
Approx. 30% total transmittance, for checking purposes, certificate included
Approx. 50% total transmittance, for checking purposes, certificate included
Approx. 70% total transmittance, for checking purposes, certificate included
Approx. 90% total transmittance, for checking purposes, certificate included
Set of 4 pieces in hard box (T30, T50, T70, T90), certificate included