

Measurement Method

$$\Delta = 2t + \frac{\lambda}{2}$$

(must equal a whole number of half-wavelengths for a bright fringe or dark fringe)

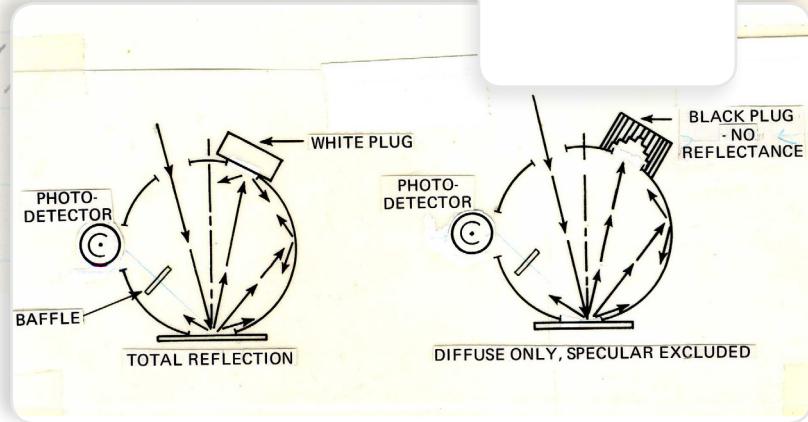
$$n\lambda = 2t + \frac{\lambda}{2}$$

$$t = \frac{n\lambda - \frac{\lambda}{2}}{2} = \frac{(n - \frac{1}{2})\lambda}{2}$$

substituting

$$D^2 = 2s \left[\frac{\lambda}{2} (n - \frac{1}{2}) \right]$$

MM 5026.00



Measuring Translucent and Opaque Bottles with UltraScan® VIS

The final color of plastic and glass bottles is often measured to ensure lot-to-lot consistency. Bottles that are translucent or opaque may be measured in reflectance, specular included (RSIN) mode using a benchtop instrument such as the UltraScan® VIS.

A HunterLab UltraScan® VIS Diffuse/8° spectrophotometer can be used to measure the reflectance of translucent and opaque bottles. The standard sample clamp may be used to hold single-wall bottle cut-outs at the reflectance port. This is the method advocated by HunterLab for the measurement of translucent and opaque bottles of various sizes. It is also possible to measure the color of whole finished bottles using a special sample holder, however the measurement is less precise than with the bottle cut-out method.

THE APPLICATION

Bottles have several non-uniform characteristics that require compensating preparation and presentation techniques in order to ensure a repeatable sample measurement.

The samples are rounded, and so consistent placement using a special handling device is required in order to make the samples appear as flat as possible to the instrument.

The samples may be translucent and will look different when backed with different backgrounds. Using a special handling device that provides a constant background will minimize this effect.

Recommended Color Scale

CIE L*a*b* as a full color descriptor

Recommended Single-Number Indices

**YI D1925 (2/C), YI E313, WI E313 when samples
are near white**

Recommended Illuminant/Observer

D65/10°.



UltraScan® VIS



MEASUREMENT METHOD

Method #1:

Measuring Bottle Cut-outs.

This method is preferred as the most repeatable and reproducible method of measuring translucent and opaque bottles.

1. Configure your software to read using the desired color scale, illuminant, and observer.
2. Install the sample clamp over the reflectance port. Ensure that the white disk (rather than the black, non-skid disk) is installed on the sample clamp. This will provide a constant white background for the cut-out.
3. Standardize the instrument in RSIN mode using large as the area view and 1-inch as the port size. This involves making measurements of the light trap and black glass.
4. Cut out a segment of the bottle sample that is at least two inches square. This area should be as flat and smooth as possible with no labels, markings, or embossed areas.
5. Cover the reflectance port with the cut-out and hold it in place using the sample clamp.
6. Measure the cut-out.
7. Rotate the cut-out 90° and take a second reading.
8. Average the two color readings for a single measurement representing its color. Averaging multiple readings with rotation between readings minimizes measurement variation associated with directionality, texture, and non-uniform color.
9. Record the average color values.



2.



3.



4.



5.

**Method #2:
Measuring Whole Bottles.**

This method should be used only when time constraints or other factors prohibit measuring bottle cut-outs.

1. Configure your software to read using the desired color scale, illuminant, and observer.
2. Install the reflectance sample shelf (HunterLab Part Number CMR-2627) at the sample port as described in the CMR addendum.
3. Standardize the instrument in RSIN mode using large as the area view and 1-inch as the port size. This involves making measurements of the light trap and white tile.
4. Locate a flat area on the bottle free of any labels, markings, or embossed areas and cover the reflectance port with this area of bottle. Hold the bottle in place using the sample clamp and the reflectance sample shelf.
5. Measure the bottle.
6. Turn the bottle over and measure it again (in a flat area free of labels, markings, or embossed areas).
7. Average the two or more color readings for a single measurement representing its color. Averaging multiple readings with rotation between readings minimizes measurement variation associated with directionality, texture, and non-uniform color.
8. Record the average color values.



2.



3.



4.

ABOUT HUNTERLAB

HunterLab, the first name in color measurement, provides ruggedly dependable, consistently accurate, and cost effective color measurement solutions. With over 6 decades of experience in more than 65 countries, HunterLab applies leading edge technology to measure and communicate color simply and effectively. The company offers both diffuse/8° and a complete line of true 45°/0° optical geometry instruments in portable, bench-top and production in-line configurations. HunterLab, the world's true measure of color.

© Hunterlab 2012



***More Information about
Measurement Methods at***

hunterlab.com

Hunter Associates Laboratory Inc.,
11491 Sunset Hills Road, Reston, VA 20190-5280 USA
helpdesk@hunterlab.com
www.hunterlab.com

