

## Measurement Method

Change of phase of  $\lambda/2$  at  $n=2$   
 $\Delta = 2t + \frac{\lambda}{2}$  (must equal a whole number of  $\lambda$  for a bright fringe or  $\lambda/2$  for a dark fringe)

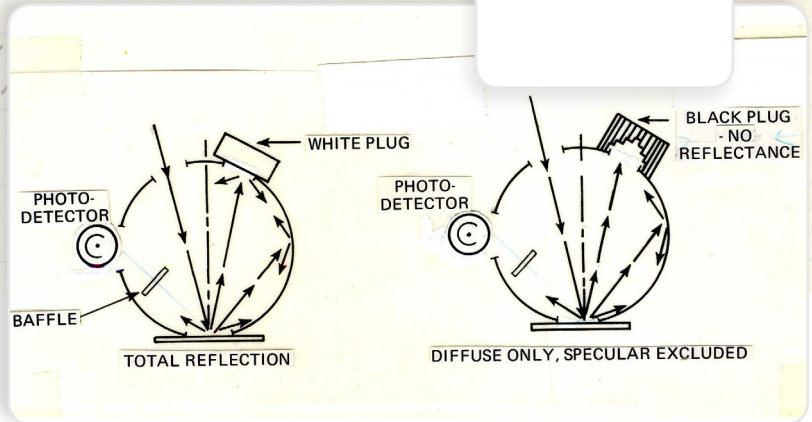
$$n\lambda = 2t + \frac{\lambda}{2}$$

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

substituting

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

MM 5040.00



## Measuring Opaque or Dense Bottle Preforms

with UltraScan® VIS

In the plastics industry, the color of plastic preforms is often measured before the preforms are blown into bottles as a predictor of the color of the final blown product. Preforms that are very dense or completely opaque may be measured at the reflectance port of a benchtop sphere instrument such as the UltraScan® VIS.

A HunterLab UltraScan® VIS Diffuse/8° spectrophotometer can be used to measure the reflectance of opaque preforms. A special reflectance preform holder is required to hold the preforms at the reflectance port. This is the method advocated by HunterLab for the measurement of opaque bottle preforms of various sizes.

### THE APPLICATION

Preforms 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 not be completely opaque and may look different when backed with different backgrounds. Using a special handling device that provides a constant background will minimize this effect.

A single preform may vary in color uniformity and wall thickness, requiring the averaging of several readings with rotation.

The samples (particularly white ones) may be fluorescent, which means that they will be sensitive to the UV content of the light source.

Recommended Color Scale

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

Recommended Illuminant/Observer

**D65/10°. C/2° may also be used.**

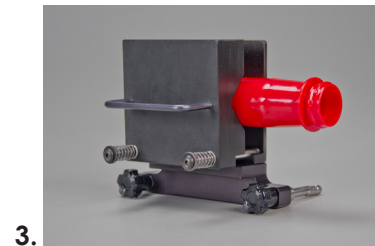


UltraScan® VIS



## MEASUREMENT METHOD

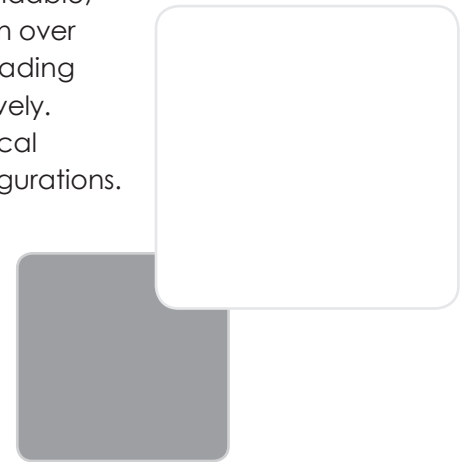
1. Configure your software to read using the desired color scale, illuminant, and observer.
2. Standardize the instrument for the small area of view in Reflectance - Specular Included mode using the light trap and calibrated white standard that come with the instrument.
3. Install the reflectance preform holder (HunterLab Part Number D02-1011-841), shown at right, as described in the user's manual.
4. Open the holder. It is easiest to do this by placing the fingers around the handle and resting the thumb of the same hand on the end of one of the spring screws. Pull the handle toward the thumb until the holder provides an opening large enough for insertion of the desired preform.
5. Insert the preform into the holder as far as the preform will go with the threads to the right. Then close the holder and confirm that the preform is held securely in place.
6. Take a single color reading of the preform. Rotate the sample  $90^\circ$  about its center axis and measure it at least twice more. Average the multiple color readings for a single color measurement representing its color. Averaging multiple readings with rotation between readings minimizes measurement variation associated with directionality.
7. Record the average color values.



## 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.

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**More Information about  
Measurement Methods at**

*[hunterlab.com](http://hunterlab.com)*

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