



HOW TO READ  
**COLOR**  
IN GLASS

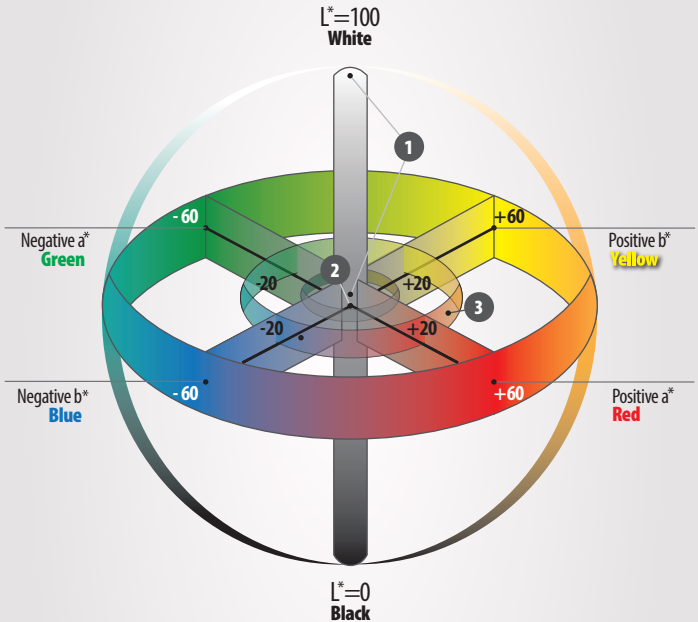
**Vitro Architectural Glass (formerly PPG glass) uses the CIE 1976 L\*a\*b\* color space globally recognized color measurement system depicted in the two panels at right to numerically define glass color on three axes:**

- **L\*** (luminance: lightness-darkness)
- **a\*** (green-red)
- **b\*** (blue-yellow)

**The L\*a\*b\* system, which incorporates values derived using sophisticated color measurement devices called spectrophotometers, enables objective, numerical comparison of color differences between objects such as glass.**

- ASTM C1376 and ASTM D2244 are the building glazing industry standards and utilize L\*a\*b\* color measurements, taken by spectrophotometer, oriented perpendicular to the glass surface.
- ASTM C1376 sets the limit of exterior reflected color non-uniformity for coated vision glass within a glazed unit and from one glazed unit to the next. Visually observable differences are possible within this specified range. (See  $\Delta E^*_{ab}$  inset on right panel.)
- ASTM C1376 also notes that glass may have a perceived color difference when viewed at angles. This is a common phenomenon and does not necessarily indicate a reason to reject the product.

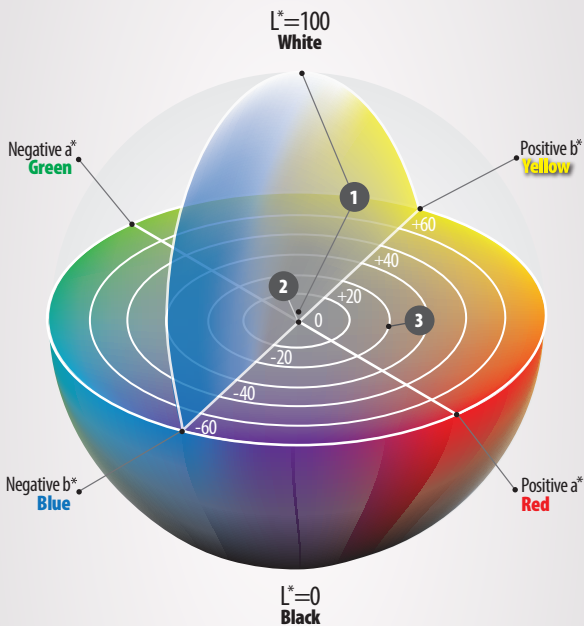
# L\*a\*b\* 3-D DIAGRAM



1 On L\* axis, the numerical color values for architectural glass typically plot between 20 and 97, representing levels of transparency from dark privacy glass in the 25 range to ultra-clear, low-iron glass in the 95-plus range.

2 The 0,0 point is considered neutral and is commonly identified as gray.

# $L^*a^*b^*$ 3-D CROSS-SECTION



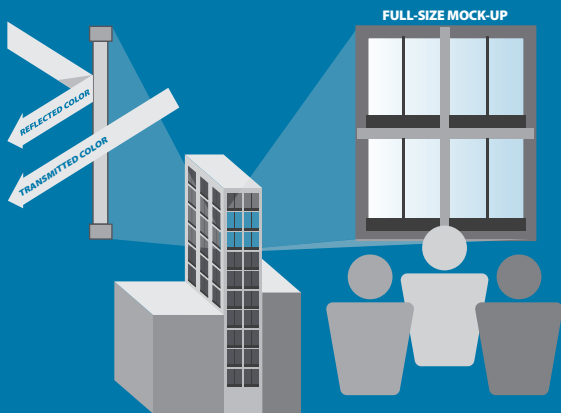
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- Most tinted and coated low-e glasses (excluding painted spandrels) are fairly neutral in color and have  $a^*$  and  $b^*$  values that range from -20 to +20.

$\Delta E^*_{ab}$  is the measurement of distance between two points represent different colors in the  $L^*a^*b^*$  color space. It enables objective comparison of glass color without the influence of ambient light or the subjective perception of a human observer.

# VITRO GLASS RECOMMENDS THE USE OF **FULL-SIZE MOCK-UPS**

Due to the many variables that may influence the perceived color of glass on a building, Vitro Glass recommends the use of full-size glass mock-ups under finished building conditions in similar building surroundings.



- Glass color is a blend of transmitted and reflected color that is influenced by many factors, including light source, the properties of the glass and any coating on the glass surfaces, interior and exterior lighting conditions, viewing angle and differences in observers. The absence of interior walls and shades during construction may also affect the perception of glass color.
- Viewing glass samples against a white surface overly emphasizes transmitted color, while a very dark background emphasizes reflected color. Glass installed on buildings includes components of each blended together.
- Glass samples should be evaluated in natural daylight since artificial light may emit wavelengths that can skew perception of glass color.
- Perceived glass color can be influenced by sample size (referred to as field size metameric failure). The color of a 12" x 12" sample may not appear the same as a 4' x 10' glazed unit of the identical glass.



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