



# STANDARD VIEWING CONDITIONS

## INTRODUCTION

Standardized viewing conditions are very important when discussing color and images with multiple service providers or customers in different locations.

For example, a designer who is viewing color under a tungsten desk lamp will see a yellow cast. If he calls his photographer to share his concerns, his description will not match the greenish colors the photographer sees under his fluorescent lights. Although they are both looking at the same print, their lighting conditions cause the colors to appear different.

When judging and comparing color, it is important to view prints and transparencies in bright, even, color-balanced light. Standards have been defined to ensure a uniform set of color viewing conditions are used worldwide, and are an important part of setting up quality color reproduction. Since all parts of the visible spectrum are equally represented in standard illumination, it provides the “greatest common denominator” of viewing conditions.

## LIGHTING STANDARD CONDITIONS

The International Organization for Standardization (ISO) specified standard illuminants for the graphic arts. The resulting technical document is used by engineers and design companies to help lighting manufacturers design, test and certify color viewing systems. The ISO document may be more technical than most users need to set up their own viewing area, but it does define five conditions that you can follow to ensure accurate color reproduction.

The ISO describes two types of viewing conditions for printed material.

- “Critical Comparison” is intended to describe the conditions under which prints are compared for color matching.
- Conditions for “Practical Appraisal” refer to lower lighting conditions that are closer to typical office light levels. This is where judgments of tone reproduction and color saturation should be made.

These conditions both have the same color quality requirements, and the color of the surroundings are the same in both cases, but they have different illumination intensity requirements.



*For more information about ISO standards, visit <http://www.iso.org>.*

### Viewing Booths



A viewing booth, like this one from X-Rite, provides accurate light simulation under a variety of lighting conditions, so you can be sure the colors you are judging are accurate.

## Condition 1: Color Quality

The quality, or “color,” of the light used in viewing artwork, printed graphics, photographs and transparencies is defined as D50 or 5000K. This was chosen because it comes close to natural daylight, or more specifically, daylight at sunrise or sunset.

**NEED TO KNOW**

# STANDARD VIEWING CONDITIONS

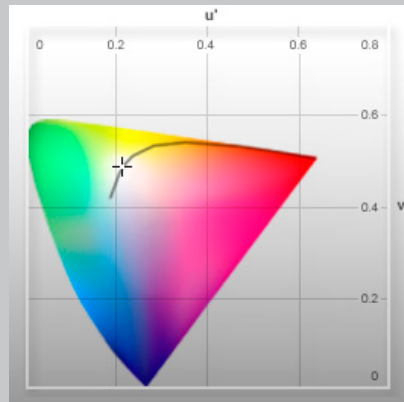
## Color Quality

Color Quality measurements in iShare



Approximate color temperature of CIE D50

## Chromaticity Diagram



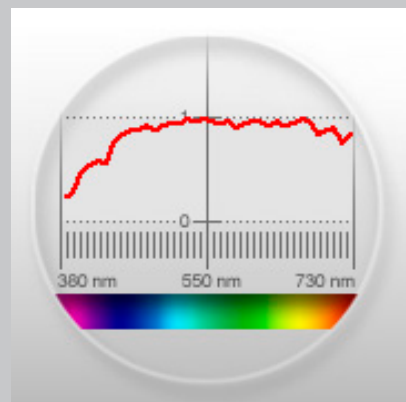
### Chromaticity

$$u'_{10} = 0.2102$$

$$v'_{10} = 0.4889$$

This shows the location of CIE D50 in the Chromaticity Diagram. It is slightly yellow and represents the “whiteness” of light in the morning or afternoon.

## Spectral Power Distribution



The spectral power distribution approximate CIE D50. As you can see, it covers the whole spectrum, but is weakest in the blue end of the spectrum.

The “fingerprint” of a light source is its spectral power distribution curve. This is the key factor in how a light source renders colors. The closer a light source’s spectral power distribution is to D50, the more accurate it will be.

The color rendering index (CRI) indicates how well the light source represents certain colors. When comparing light sources, the higher the CRI, the more accurate the light. The chart on the next page shows color quality measurements for D50 in iShare.

## Condition 2: Light Intensity

Consistent light intensity is critical to consistent image rendition. You need an intensity that provides full tonal visibility of shadow detail without washing out highlights. Intensity is specified in lux for prints and candelas per meter squared (cd/m<sup>2</sup>) for transparencies. It is recommended that your critical color decisions be made under light that is around 2000 lux (preferably between 1750 and 2250lux, but definitely between 1500 and 2500lux).

The light from a bright desk lamp can be around 2000 lux when measured from the desk. However, intensity is not the only thing you need to look at. You also need to view the tonal reproduction in a lower light intensity (800 lux), which is similar to typical office lighting levels.



*Using an iPro with iShare software, measure your lighting to see how close it is to these values.*

## Condition 3: Evenness of Illumination

Proper evaluation of images requires even illumination that is free from hot-spots and fall-off. Varying illumination across images could obviously cause misinterpretation of image quality and uniformity. Evenness is specified as a percentage of nominal,



# STANDARD VIEWING CONDITIONS

meaning the specified light intensity. For example, print illumination must be 60% of nominal, meaning that if light is the specified 2000 lux in the center of the viewing booth, it must be at least 1200 lux in the corners.

## Viewing Condition Standards

### Light Intensity

Prints and Proofs  
Casual Viewing (exhibition)—800 lux  
Judging—2000±500 lux (required)  
Judging—2000±250 lux (preferred)

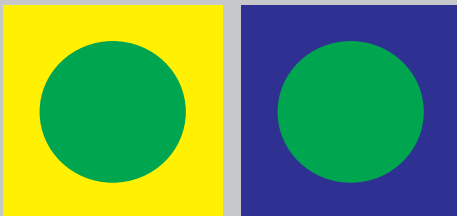
Transparencies  
1270±320 cd/m<sup>2</sup> (preferred)  
1270±160 cd/m<sup>2</sup> (required)

### Evenness of Illumination

Prints—at least 1200 lux (60% of nominal) intensity at all points on viewing surface

Transparencies—at least 953 cd/m<sup>2</sup> (75% of nominal) intensity at all points on viewing surface

### Surround



Are the two green circles the same color? Actually, yes. Their surround affects their appearance.

Prints—neutral matte surround with luminous reflectance of 10–60% (comparable to Munsell N8/gray)

Transparencies—5–10% luminance level 50 mm on all sides



In this example, the L\* is 70.9, which is a light color, and both a\* and b\* are near 0. This is a good light neutral gray.

## CONDITION 4: SURROUND

The color of surrounding objects affects color perception, both from light reflected off these objects and from adjacency when we perceive them in our field of view. The viewing standard therefore specifies a neutral gray. To test this out, take a measurement with an i1 or ColorMunki™ and examine the L\*a\*b\* values. The L\* value is not specifically defined, but should be a middle to light grey. For a photographer, this would be similar to a photographic gray card. To be neutral, the a\* and b\* values should be close to 0.

## CONDITION 5: GEOMETRY

Reflected glare is not only distracting when evaluating color prints, it can hide reproduction detail. The specification does not explicitly specify lighting geometry, but it does state that the light source, image, and observer must be positioned to avoid glare.

## METAMERISM

Metamerism is another reason you need to ensure proper viewing conditions when judging color. This phenomenon occurs when two colors appear to match under one lighting condition, but due to their different spectral power distributions, they are not actually the same color. You may have experienced metamerism when you got to work and realized the two black socks that matched in your lamp lit bedroom are not the same color under your fluorescent office lights.

Metameric matches are quite common, especially in near neutral colors, such as grays and whites, and dark colors. As colors become lighter or more saturated, the range of possible metameric matches becomes smaller.



*For more information, check out X-Rite Color Service's Metamerism Need To Know document.*

# NEED TO KNOW

## STANDARD VIEWING CONDITIONS

### CONCLUSION

Standard viewing conditions are an important part of setting up quality color reproduction. Since all parts of the visible spectrum are equally

represented in standard illumination, it provides the “greatest common denominator” of illumination. Moreover, the standard specifies a uniform and set of conditions for viewing color that can be utilized throughout the entire world.

### Light Sources



Light source, image, and observers eyes must be positioned such that specular reflectance (glare) is minimized.



This image shows the same X-Rite ColorChecker Passport target photographed in a SpectraLight III light booth under three different lighting conditions. Left: D50/50, Middle: Office Fluorescent, Right: Home Tungsten



Classroom  
Training



On-Site  
Training



eLearning  
Training

For information on a variety classroom, custom on-site, and highly interactive on-line training options, see X-Rite’s Color Services web site at [http://www.xrite.com/top\\_services.aspx](http://www.xrite.com/top_services.aspx)

Contact us at:

Email: [training@xrite.com](mailto:training@xrite.com)

Phone: 800.248.9748 x2685