What is the viewing standard?

ISO 3664:2009

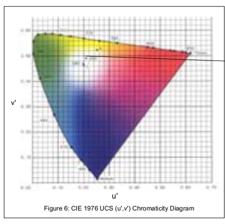
Viewing Conditions - for Graphic Technology and Photography

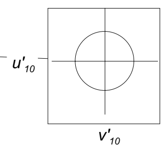
The standard is a technical document which is written with engineers and lighting design companies in mind. It is not a road map for users who wish to build or set up their own viewing area, rather it is a highly technical set of specifications which enables lighting manufacturers to design, test, and certify color viewing systems. The standard specifies a set of five conditions which ALL must be present in order to assure the benefits of the standard. The five conditions include:

Color Quality

chromaticity

Chromaticity aimpoint u'_{10} = .2102, v'_{10} = .4889



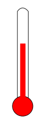


Tolerance of .005 radius around aimpoint

The apparent color of a light source is specified by its chromaticity coordinates. The aimpoint and tolerance are specified in CIE color space. When two viewing systems are plotted, the closer the plot, the greater the visual agreement between the viewers' color appearance.

*color temperature**

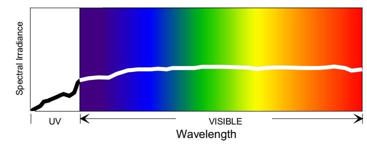
5000K



* Correlated color temperature is the correlation between the color emitted by a black body radiator when heated to a specific temperature. It is measured in Kelvins.

spectral power distribution

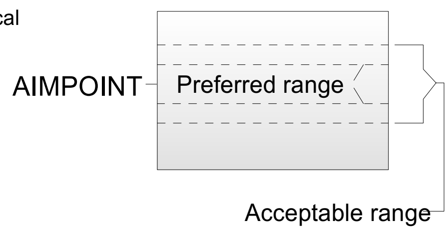
approximate CIE D_{50}



The true "fingerprint" of a light source. The spectral power distribution is the key factor in how a light source renders colors. The closer a light source's spectral power distribution is to D_{50} the more consistent and accurate it is. CRI and CIE51 tests are used to insure that your light source closely approximates D_{50}. New in 2009 is a tighter match in the UV region.

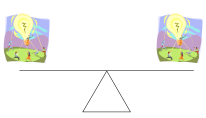
Light Intensity

Consistent light intensity is critical to consistent image rendition. The standard provides a target intensity designed to allow full tonal visibility of shadow detail without washing out highlights. Part 2 "practical appraisal" specifies a lower light intensity (500 lux) for tone reproduction evaluation.

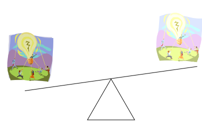


	prints & proofs	*transparencies*
	2000 lux	*1270 cd/m²*
preferred (should be) tolerance	*+/- 250 lux*	*+/- 160 cd/m2*
required (shall be) tolerance	*+/-500 lux*	*+/- 320 cd/m2*

Evenness



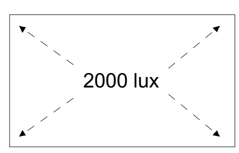
Even light intensity across image assures correct interpretation of print / reproduction quality.



Intensity differences across image cause incorrect interpretation of print / reproduction quality.

prints & proofs

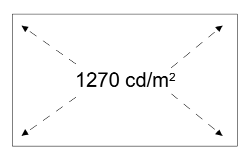
within 60% of nominal



at least 1200 lux (60% of 2000) intensity at all points on viewing surface

transparencies

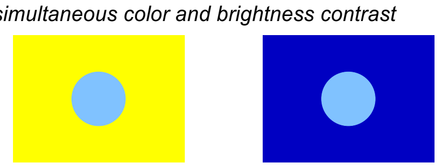
within 75% of nominal



at least 953 cd/m² (75% of 1270) intensity at all points on viewing surface

Surround

simultaneous color and brightness contrast



prints & proofs

neutral and matte surround with luminous reflectance of between 10% and 60%.

note: 60% reflectance is comparable to existing viewing systems using Munsell N8/ gray.

transparencies

5%-10% luminance level 50 mm on all sides

Surround color and reflectance affect color appearance. The two light blue dots above left appear different in both hue and brightness due to the differences in the background field. In order to assure consistent color appearance and tonal range, the surround condition is specified.

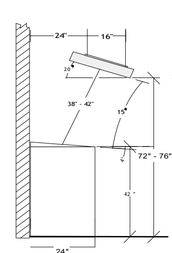
Geometry

Improper geometry
excessive glare

Proper geometry
minimal glare

Light source, image, and observer's eyes positioned such that specular reflectance (glare) is minimized.

The presence of excessive glare can be very distracting to press operators, QC personnel, and others attempting to make critical color judgements. As illustrated by the images to the left, glare can hide reproduction detail and potentially cause very costly errors. While the standard does not explicitly specify lighting geometry, GTI has tested nearly all techniques and found that there is an optimal geometry for each installation (see example to right).



A *system* of elements designed to increase your bottom line.

Have more questions?
Ask GTI, it's our favorite subject.

WARNING: the graphic arts industry has PROVEN that consistent color appearance & effective color communication depend on YOUR lighting / viewing environment! Only by meeting all of the above elements will your viewing system provide maximum benefits.

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What is the viewing standard?

ASTM D1729-09

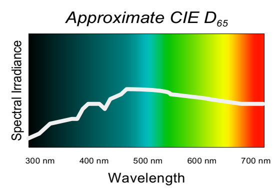
Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

The color and appearance of materials is dependent on the geometry, quantity, and spectral nature of the illumination as well as the surround conditions / viewing environment. This standard specifies the conditions for critical visual color appraisal for color matching. The use of spectrally dissimilar illumination sources allows effective detection of a 'conditional' or metameric color match (a good color match under one light source, but a color mismatch under a different light source). An equally important function of the standard is to allow effective communication of color between parties working together on color critical jobs.

Quality of Simulated Daylight

Spectral Power Distribution: Daylight

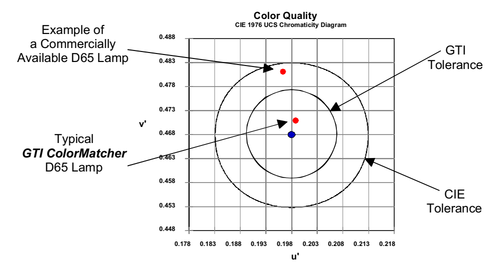
CIE D_{65} Average North Sky Daylight- The standard specifies this source for color matching applications. Prior to the 1990's, D_{75} was specified as the standard source in the USA. In the graphic arts and photographic industries D_{50} is the standardized source and is referenced in ISO 3664.



It is the true "fingerprint" of a light source. The spectral power distribution is the key factor in how a light source renders color. The closer a light source's spectral power distribution is to the CIE specification for the standard light source, the more consistent and accurate it is. CRI and CIE51 tests are used to ensure that your light sources closely approximate D65.

Chromaticity

The apparent color of a light source. Each daylight source has an aim-point and circular tolerance specified in CIE color space (UCS 1976) as illustrated at right.



D65: u' = 0.198, v' = 0.468

CIE Publication 51 Rating (BC)

Specifies how well a light source simulates daylight. A minimum rating of BC is required for critical color matching applications. The rating is in two parts, where the first letter represents the visible portion of the light source and the second letter represents the ultraviolet portion of the light source. An "A" rating indicates there is less than a 1/4 Delta E difference between the metameric pairs listed in the CIE publication. A "B" rating indicates there is between a 1/2 and 1/4 Delta E difference, a C rating indicates there is between 1 and 1/2 Delta E difference and so on. An E rating is the lowest. All of GTI's color matching products have a minimum rating of BC.

Color Temperature

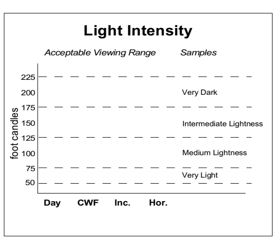
Color temperature - 6500K (D65)- Correlated color temperature is the correlation between the color emitted by a black body radiator when heated to a specific temperature. It is measured in the Kelvin temperature scale. Other common color temperatures are 7500K, 5000K and 2856K (Illuminant A).

Additional Light Sources (Metamerism)

Various sources are described in the standard. These include Artificial Daylight - specifically D65, Incandescent - specifically Illuminant A and a source at 2300K and Cool White Fluorescent - a.k.a. CWF. Other light sources may be used as required. These include various commercial fluorescent lamps including Ultralume 30 (30U), TL84 and TL83 to name a few. GTI Graphic Technology, Inc. offers each of the standard sources as well as commercially available fluorescent sources. A combination of these sources, specifically D65, CWF (or TL84), and Illuminant A, are ideal for the detection of metamerism. Ultraviolet (UV) can be included to detect the presence of optical brighteners or whiteners.

Light Intensity

Consistent light intensity is critical to consistent color evaluation. The standard provides a target intensity range designed to allow full tonal visibility of dark samples without over illuminating light samples.

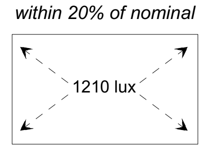


very light materials - *as low as 540 lux (50 fc)*
medium lightness - *1080-1340 lux (100-125 fc)*
very dark materials - *as high as 2150 lux (200 fc)*

Most light booths maintain an intensity of 1210 lux. The typical procedure for viewing samples at higher light intensities is to hold the sample closer to the light source.

Light Evenness

within 20% of nominal



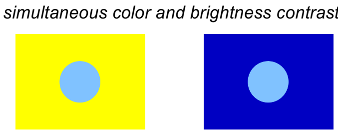
At least 968 lux (20% of 1210) and not more than 1462 lux intensity at all points on the viewing surface.

Even light intensity across sample assures correct interpretation of color quality!

Surround

Surround color and reflectance affect color and appearance. The two light blue dots at right appear different in both hue and intensity due to the differences in the background field. In order to assure consistent color perception and tonal range, the surround condition is specified.

simultaneous color and brightness contrast



neutral and matte surround with luminous reflectance of between 30% and 43%

note: 43% reflectance is comparable to existing viewing systems using Munsell N7/ gray

Geometry

Improper geometry - excessive glare

Proper geometry - minimal glare

Light source, image, and observer's eyes positioned such that specular reflectance (glare) is minimized but sufficiently directional so that physical appearance aspects of the sample can be detected.

The presence of excessive glare can be very distracting to observers attempting to make critical color judgments. Glare can influence color perception and result in very costly errors. Likewise, the effects of geometric metamerism, if not taken into account in the evaluation observations, will result in color mismatches.

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Have more questions? Ask GTI, it's our favorite subject.

WARNING: the color related industries have PROVEN that consistent color appearance & effective color communication depend on YOUR lighting / viewing environment! Only by meeting all of the above elements will your viewing system provide maximum benefits. GTI Graphic Technology, Inc. meets or exceeds the parameters set forth in this standard with all of its color and appearance lighting systems.

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