



The Industry Voice for Workplace Solutions

**Standard for Color Measurement for  
Office Furniture Manufacturers and Suppliers**

BIFMA International

Date: October 19, 2005

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# **BIFMA Color 3.1-2005**

## **Standard for Color Measurement for Office Furniture Manufacturers and Suppliers**

### **1 Scope/Background**

The scope of this document is to standardize a method of visual and numerical requirements for color evaluation. The BIFMA Color Working Group's intent was to take voluminous standards already written for color evaluation and make them more user-friendly to the furniture industry. Great care was taken to maintain the integrity of the more voluminous publications while simplifying the language. The BIFMA Color Working Group believes this document to be a practical bench top document.

Final evaluation for pass/fail should be performed visually as prescribed by this document to qualify the visual evaluation for tolerances or customer-to-supplier communication. Additionally, instrumental evaluations will aid in the communication of perceived color differences.

## 2 Definitions

**Note:** Refer to BIFMA PD-1 Industry Product Definitions for related terms not included in this standard. Otherwise, the common dictionary definition shall be used for terms not defined in this section or BIFMA PD-1.

- 2.1 CANDELA:** The luminous intensity in the perpendicular direction of a surface of 1/600,000 meters squared ( $m^2$ ), one candela produces 1 meter (m) of luminous flux per steradian of solid angle measured from the source.
- 2.2 CENTER 2/3 OF LIGHT BOOTH:** Samples being observed should be centered in observation area and should not be any closer than 1/6 of the length or width of the observation area to any wall or opening.
- 2.3 COOL WHITE FLUORESCENT:** CIE illuminate F2 with a correlated color temperature of 4150° K ( $\pm 200^\circ$  K).
- 2.4 CRITICAL COLOR EVALUATOR:** An individual who has passed the annual Ishihara Color Blindness Test, and the Farnsworth-Munsell 100 Hue Test, and is responsible for evaluating color matches either alone or as part of a committee.
- 2.5 COLOR TEMPERATURE:** The temperature at which the walls of a uniformly heated furnace must be maintained so that light from a small hole in it shall yield the chromaticity of the source whose color temperature is to be specified, given in degrees Kelvin.
- 2.6 DAYLIGHT:** CIE illuminate D65 with a correlated color temperature of 6500° K ( $\pm 200^\circ$  K)
- 2.7 DIFFUSE REFLECTION:** Process by which incident light is redirected over a range of angles from the surface on which it is incident.
- 2.8 FILL:** Yarns that run horizontally in woven goods, at right angles to the WARP yarns.
- 2.9 FLOP:** The orientation of a sample, to change the angle or reverse the direction of the pile so as to match that of the master for comparison.
- 2.10 FOOT CANDLES:** The unit of illumination of a surface placed at a distance of one foot from a light source having a luminous intensity of one candela.
- 2.11 GLARE:** Reflection of light that interferes with perception of underlying color attributes.
- 2.12 HORIZON:** CIE illuminate with a correlated color temperature of 2300° K ( $\pm 200^\circ$  K).

- 2.13 **INCANDESCENT:** CIE illuminate A with a correlated color temperature of 2850° K ( $\pm 200^\circ$  K).
- 2.14 **LIGHT SOURCES:** Those elements in an instrument or in the visual observing situation that furnish radiant energy in the form of light.
- 2.15 **MASK:** An opaque covering having an aperture that will isolate an area for observation. Usually used to cover surfaces of colors other than the one being evaluated.
- 2.16 **MASTER:** A reference against which measurements are made.
- 2.17 **METAMERISM:** The phenomenon whereby colors of specimens match when illuminated by light of one spectral composition despite difference in spectral reflectance of the specimens, and that consequently may not match in light of some other spectral composition.
- 2.18 **OPAQUE PLASTICS:** Plastics, which reflect all light so that none passes through.
- 2.19 **OPACITY:** The degree to which a sheet of film obscures a pattern beneath it.
- 2.20 **OVERHEAD LUMINAIRE:** A lighting fixture attached to the ceiling of a room used for evaluation of color samples larger than a light for which both will allow.
- 2.21 **PRIMARY LIGHT SOURCE:** A light source that closely approximates typical product end use viewing conditions.
- 2.22 **SOLID LAMINATE:** Laminate which is uniform in color and contains no pattern.
- 2.23 **WARP:** The yarns that run vertically or lengthwise in woven goods.

### **3 Primary and Secondary Light Source**

The primary light source provides the first condition under which an acceptable color match of sample to master is defined. A secondary light source may also be used to illuminate the master and sample to provide additional conditions under which they may be an acceptable match.

#### **3.1 Light Sources**

It is important the customer and supplier agree on the primary and secondary light sources. The light sources used could include:

Cool White Fluorescent CIE illuminate F2 of 4150° K ( $\pm 200^\circ$  K)

Daylight CIE illuminate D65 of 6500° K ( $\pm 200^\circ$  K)

Horizon illuminate of 2300° K ( $\pm 200^\circ$  K)

Incandescent CIE illuminate A of 2850° K ( $\pm 200^\circ$  K)

#### **3.2 Best Practices**

The best practice for color measurement is no ambient light present during the evaluation. Ambient lighting can affect a person's ability to properly judge color. In order to maintain the integrity of the master, cleaning is highly discouraged. Farnsworth-Munsell 100 Hue Test to be administered to Appraisers once a year.

## **4 Evaluation of Painted and Solid Laminate Surfaces**

### **4.1 Visual Evaluation**

- 4.1.1 The optimum sample size should be at least 3 in. (76 mm) by 5 in. (102 mm).
- 4.1.2 The gloss, texture, and finish of the sample must meet the product specifications.
- 4.1.3 The sample and the master should visually match, regardless of unlike surface characteristics.
- 4.1.4 Carefully remove the master from the sleeve; no finger contact with primary surface.
- 4.1.5 Handle the master by the edges to minimize finger contact.
- 4.1.6 Position the master and sample on the same plane in the center two-thirds of the light booth in a 45/0 degree geometric condition or agreed upon by customer and supplier.
- 4.1.7 Compare the sample to the master.
- 4.1.8 Switch the position of the master and sample from left to right for further evaluation.
- 4.1.9 Because of different pigments, it is important that once an evaluation under the specified light source is made, an additional light source may be used to check for metamerism difference.
- 4.1.10 When evaluating textured surfaces or metallic painted surfaces, multiple viewing angles should be agreed upon by customer and the supplier.

## 4.2 Instrumental Evaluation

1.	Color System	CIE Lab
2.	Primary Light	F, D65, A
3.	Secondary Light	F, D65, A
4.	Tertiary Light	F, D65, A
5.	Observer	10 Degree
6.	Specular Component	Excluded*
7.	Instrument Type	Sphere
8.	Ultraviolet Light	Included

\* Actual method to be agreed upon between the customer and supplier.

- 4.2.1 Carefully remove the master from the sleeve; no finger contact with primary surface.
- 4.2.2 Handle the master by the edges to minimize finger contact.
- 4.2.3 Perform a visual evaluation of both the sample and the master for excellence of condition.
- 4.2.4 Read master per spectrophotometer manufacturer's instruction; average at least three readings.
- 4.2.5 Read sample per spectrophotometer manufacturer's instruction; average at least three readings.

## 4.3 Storage of Masters

- 4.3.1 Minimum storage requirements masters shall be:
  - a) Protected by a non-acidic paper sleeve.
  - b) Stored in a constant environment to minimize effects due to extreme temperature, humidity, light, dust, U-V degradation, grease, or oils.

**Note:** In order to maintain the integrity of the master, cleaning is highly discouraged.

## **5 Evaluation of Plastics**

### **5.1 Visual Evaluation**

- 5.1.1 The gloss, texture, and finish of the color sample must meet the product specification.
- 5.1.2 The color sample and master should match visually, regardless of unlike surface characteristics.
- 5.1.3 The sample and master should be placed side by side, in the center two-thirds of the light booth at the same plane.
- 5.1.4 Carefully remove the master from the sleeve; no finger contact with primary surface.
- 5.1.5 Handle the master by the edges to minimize finger contact.
- 5.1.6 Initially compare the sample with the master at a 45/0 (facing observer) position.
  - a) As needed, travel slowly downward until you find an angle that diminishes or eliminates the effects of glare from the sample and master surface.
  - b) Samples with gloss in the medium to high range (50 units or more) and no texture which exhibit a great deal of glare can be reduced by vertically placing a piece of flat black fabric at the back of the light booth to prevent light from reflecting off their mirror-like surface.
  - c) Some textures have a directional orientation so like textures should be viewed in the same directional orientation in order to effectively perceive their true color difference.
- 5.1.7 Because of different pigments, it is important that once an evaluation is made, an additional light source may be used to check for metameric difference.

## 5.2 Instrumental Evaluation

1.	Color System	CIE Lab
2.	Primary Light	F, D65, A
3.	Secondary Light	F, D65, A
4.	Tertiary Light	F, D65, A
5.	Observer	10 Degree
6.	Specular Component	Excluded*
7.	Instrument Type	Sphere
8.	Ultraviolet Light	Included

\*Actual method to be agreed upon between the customer and supplier

- 5.2.1 Carefully remove the master from the sleeve; no finger contact with primary surface.
- 5.2.2 Handle the master by the edges to minimize finger contact.
- 5.2.3 Perform a visual evaluation of both the sample and the master for excellence of condition.
- 5.2.4 Read master per spectrophotometer manufacturers instruction; average at least three readings.
- 5.2.5 Read sample per spectrophotometer manufacturers instruction; average at least three readings.

## 5.3 Storage of Masters

- 5.3.1 Minimum storage requirements masters shall be:
  - a) Protected by a non-acidic paper sleeve.
  - b) Stored in a constant environment to minimize effects due to extreme temperature, humidity, light, dust, U-V degradation, grease, or oils.

**Note:** In order to maintain the integrity of the master, cleaning is highly discouraged.

## **6 Evaluation of Textiles**

### **6.1 Visual Evaluation**

- 6.1.1 Specimen size should be at least 5 in. (127 mm) by 7 in. (180 mm) or representative of pattern repeat.
- 6.1.2 Textile products will be examined in either of two geometric conditions:
  - a) At 0/45 degrees with the master and sample at the floor of the light booth, or equivalent configuration with a luminaire.
  - b) At 45/0 degrees (approximately) with the master and the sample placed against the rear wall of a light booth, or equivalent configuration with an overhead luminaire.
- 6.1.3 The master and the sample will be placed alongside each other in the same plane, with identical warp and fill orientation. One specimen must not be placed on top of the other.
- 6.1.4 Switch the position of the master and sample from left to right for further evaluation.
- 6.1.5 Depending on the construction or appearance, both master and sample will be rotated together 90 degrees and 180 degrees for further comparison.
- 6.1.6 Because of different dyestuffs and dyeing procedures, it is important that once an evaluation under the specified light source is made, that additional light sources are checked for metameric differences.

## 6.2 Instrumental Evaluation

1.	Color System	CIE Lab
2.	Primary Light	F, D65, A
3.	Secondary Light	F, D65, A
4.	Tertiary Light	F, D65, A
5.	Observer	10 Degree
6.	Specular Component	Excluded
7.	Instrument Type	Sphere
8.	Ultraviolet Light	Included

6.2.1 Evaluate for excellence of condition.

6.2.2 Present master to spectrophotometer:

- a) Position master on area to be read and note directional orientation of that position.
- b) Read master per spectrophotometer, manufacturing instrument averaging to be agreed upon by customer suppliers.

6.2.3 Present sample to spectrophotometer. Repeat procedure in step 6.2.2 using the noted directional orientation.

6.2.4 Compare and record data.

## 6.3 Storage of Masters

6.3.1 Protect by a plastic or paper sleeve.

6.3.2 Store in a constant environment to minimize effects due to extreme temperature, humidity, light, dust, U-V degradation, grease, or oils.

6.3.3 Absolutely no cleaning of textile masters.

6.3.4 Master replacement must be agreed upon by customer and supplier.

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