

## 4. ACT Color Measurement & Communication Voluntary Guidelines & Glossary

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### Background

To help everyone “speak the same language” when discussing color, the ACT Color Measurement & Communication Committee created the following set of guidelines to establish uniform methods of evaluating, cataloging, and matching standards. A survey of ACT members was used as a basis in developing these guidelines. The intent of these guidelines is educational; the guidelines are not to be interpreted as a standard. All decisions regarding color quality shall be determined between individual parties.

### Committee Members:

Peter Kuklinski, MTL, *Co-chair*  
Craig Platt, Designtex, *Co-chair*  
Janan Rabiah, ACT  
Joe Kilby, Schumacher  
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### Overview

The subject of color is close to each one of us. We all encounter color in a multitude of ways during any given day. The influences of these colors can be subtle and unrealized, powerful and moving, or somewhere in between. For this reason, the beauty and moods of color are a critical component of interior design, and high value is entrusted upon the manufacturers and distributors of furnishing textiles to provide attractive, consistent, and durable colors. The nuances in bringing color quality to fruition can be challenging. The process of communicating these intricacies is at the heart of this document.

Art and science merge to take center stage within the scope of color analysis—the creation and duplication of color encompasses both disciplines. We must also keep in mind that both subjective and objective views of color influence communication about color quality, for color ultimately lies in the eye of the beholder, and like the uniqueness of fingerprints, no pair of eyes see the same thing.

## **Voluntary Guidelines**

### **Establishing the Initial Product Standard (Master Sample)**

#### *Minimum Recommended Procedures*

When creating a standard or master sample for a new product, ACT recommends the following:

1. Final approval standard should be cut from the initial production run and not from sample blankets, lab dips, test yardage, etc.
2. The standard should be a minimum size of a 5" x 7" or a full repeat.
3. The standard should be stored in a protective sleeve away from light and any other harmful environmental conditions. Recommended sleeve is heavyweight non-glare.
4. Supplying mills should maintain a standard sample in both loom state as well as finished state to help identify where color shifts or any other issues may occur.
5. In cases in which after-mill finishes are applied, it is recommended that standards be kept in both original and after-finish state.
6. Suppliers are responsible for advising customers if production has shifted from standard color prior to shipping the order. Customers can then determine acceptance of product and if a new standard should be established.

### **Other Considerations**

In light of the significant number of technical factors associated with color development and evaluation, it must be noted that color quality is influenced by numerous factors that are not completely controllable. With this understanding, a range of acceptability to a given standard will exist between parties. Among the most common fluctuations that may influence color matching are the following:

1. Water quality is affected by seasonal and regional circumstances and is most often revealed by the pH (acidity/alkalinity) of the water used in a given process. Numerous other factors such as sodium content can also have an impact on color repeatability.
2. Availability and continuity of various dyestuffs and chemicals directly influence color development. As society becomes more environmentally responsible, and certain practices are altered to foster a cleaner, healthier environment, changes in the formulation of dyestuffs are inevitable.
3. Color consistency may be affected by any changes in the location where a fiber is grown, made, or dyed. Additionally, materials management faces the challenge of securing secondary or replacement sourcing from time to time due to various factors, and these changes will also affect color consistency.
4. Variations in raw fibers (un-dyed natural or synthetic) caused by changes in the environmental or production conditions of the fibers will affect dye consistency.
5. Wet and mechanical finishing and high heat can affect the overall coloration of a textile. Common wet finishes include washes, scours, flame retardant treatments, backings, stain repellents, and stability immersions. Mechanical and dry finishes include calendaring, mechanical softening, heat setting and framing.

## Visual Evaluation

### Light Booth

A light booth is recommended for visual evaluation of color. Currently, ACT members most commonly use light booths manufactured by X-Rite / Gretag MacBeth.

*Best Practice – have the light booth serviced on a regular basis by the light booth manufacturer.*

### Light Sources

Primary and secondary light sources to be used to communicate color need to be agreed upon between respective parties. The light sources could include:

1. Daylight CIE illuminant D65 of 6500 K
2. Cool White Fluorescent CIE illuminant F2 of 4150 K
3. Incandescent CIE illuminant A 150 watt of 2850 K

Light sources other than those listed above may be beneficial when checking for metamerism (possibly signaling unacceptability) or for specific requirements agreed upon between respective parties.

Please note: color *can not* be perfectly matched using three different light sources. Most matching is conducted with primary and secondary light sources only.

*Best Practice – A primary and secondary light source should be agreed upon between the supplier and the customer.*

### Procedure

Proper viewing conditions and positioning of the sample and the standard on an exam stand are essential for evaluation consistency.

- Samples should be parallel and touching.
- Sample and master specimens should be from identical areas of a given design positioning each sample in the same plane, with identical warp and fill orientation. All measures must be taken to ensure that sample orientation is identical.
- All samples should be viewed under primary and secondary light sources. Color judgments should be made quickly because sensitivity of the eye to color differences decreases with time of exposure.

*Best Practice - Administer the Farnsworth-Munsell 100-Hue Test or similar type of test to all individuals who evaluate color.*

## Instrumental Evaluation

If a spectrophotometer is used for color measurements of any kind, the following specifications are recommended:

### Specifications:

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

## Glossary

**AATCC:** Abbreviation for the American Association of Textile Chemists and Colorists, the world's largest society devoted to the advancement of textile chemists, particularly in textile wet processing. AATCC publishes a Technical Manual of test methods divided into six categories: Biological Properties, Colorfastness, Dyeing Properties, Evaluation Procedures, Identification and Analysis (fiber and chemical), and Physical Properties, with heavy emphasis on color-related textile properties. [www.aatcc.org](http://www.aatcc.org)

**chroma:** The strength or purity of a color. Chroma is the characteristic that indicates saturation of color and amount of color (hue) in an object compared to a gray color with the same value. Accordingly, black, gray and white have zero chroma. Chroma is expressed by numbers from 1 to 12; within the range, a higher number corresponds to a color with higher saturation.

**color abrasion:** Color changes that result from wear in specific areas of a fabric. Also called frosting.

**color attributes:** The color of a material is described by the attributes of hue, value, and chroma in relationship to one another.

**color communication systems:** Systems of color measurement that allow for more consistent color communication and duplication. Examples include: Colorcurve, Munsell, Natural Color System and Pantone.

**color evaluation standards:** Parameters agreed upon between parties to evaluate and match color. Gray scale is the standard practice for visual evaluation of colors. Evaluation with a spectrophotometer may provide a second opinion, but remains optional; visual evaluation is primary and essential.

**colorfastness:** The ability of a material to resist color change or color transfer when exposed to various physical and environmental conditions during processing, storage, or use. Although dozens of tests evaluate aspects of colorfastness, upholstery, wallcovering, panel, cubicle and drapery fabrics are most commonly tested for Colorfastness to Light (AATCC 16) and Colorfastness to Crocking (AATCC 8).

**color discrimination/perception:** The sensation of color is the result of the human eye's ability to differentiate spectral differences of light reflected from a specific material.

**color measurement:** Quantitative specification of color using data from a measuring device such as a spectrophotometer.

**color stripper:** A chemical used to extract dyestuffs from fiber in order to correct, lighten or remove color in yarn or fabric.

**color temperature:** To communicate hue as it applies to color, the descriptive terms warm (yellow, orange, red) or cool (blue, violet) are commonly used.

**COM:** Abbreviation for “customer’s own material”, which refers to a customer’s choice of any material other than the standard fabric offered by the furniture manufacturer.

**computerized color visualization:** Appraisal or determination of color on a computer screen instead of looking at the actual material (visual evaluation). Actual color can look different on a computer screen as a result of various conditions such as lighting and screen resolution. Computer screens can be calibrated to improve color communication.

**crocking:** Transfer of dye from the surface of a dyed or printed material onto another surface by rubbing.

**dyeability:** The capacity of fibers to accept dyes.

**dyeing:** The process of coloring fibers, yarns, or fabrics with either natural or synthetic dyes. Examples of major dye processes include batch dyeing, beam dyeing, continuous dyeing, jet dyeing, package dyeing, piece dyeing, skein dyeing, solution dyeing, and others.

**dye lot:** A quantity of textile fiber, yarn, or woven goods dyed in one production run. Lot size can vary greatly depending on the dyeing processes and equipment of specific mills or finishing plants.

**dyes:** Substances that add color to textiles. Dyes are incorporated into the fiber by chemical reaction, absorption, or dispersion. Dyes differ in their resistance to sunlight, perspiration, washing, gas, alkalies and other agents; their affinity for different fibers; their reaction to cleaning agents and methods; and their solubility and method of application. Examples of standard dye types include acid dyes, basic dyes, disperse dyes, cationic dyes, fiber reactive dyes, and others.

**dye streak:** Uneven dyeing due to differential shrinkage of yarns or the formation of creases or improper chemical reactions during the dye process. These conditions can result in variations of color that appear as lines or streaks running in the warp or fill direction.

**foot candle:** The quantity of light at a point on a plane surface one foot from and perpendicular to a standard candle.

**glare:** Excessive or unacceptable surface brightness that inhibits the ability to view or evaluate a color.

**hue:** The attribute of color that identifies the color as being yellow, blue, red, etc. The Munsell system uses the following colors: violet, violet-blue, blue, blue-green, green, green-yellow, yellow, yellow-red, red and red-violet. Each one of these hues is further divided into ten subdivisions.

**instrumental color evaluation:** Using a device such as a spectrophotometer for color comparison.

**lab dip:** A sample of yarn or fabric dyed in a laboratory for color approval so that the approved color can then be recreated in production.

**light box:** A contained box-like apparatus scientifically designed to house various controlled lighting conditions for color evaluation purposes.

**light fastness:** The degree of resistance a textile or dyestuff has to sunlight exposure. A rating system of 1-5 is used to evaluate light fastness, with 5 representing the highest degree. Two methods of testing are used:

1. Exposure to sunlight, either directly or under glass
2. Accelerated testing in a laboratory with artificial light sources.

**light sources:** The specific sources of light (settings) used in a light box to illuminate the standard and sample for color evaluation. The three most common are:

- Daylight (D65) the color temperature of 6500 K. This source is typically provided by filtered tungsten halogen lamps. Simulates North sky daylight.
- Cool White Fluorescent (CWF) the color temperature of 4150 K. This source is typically provided by cool white fluorescent tubes. Simulates typical office or store lighting.
- Incandescent – (INC A -150 watt) the color temperature is 2850 K. This source is typically provided by tungsten halogen lamps. Simulates typical home, or store accent lighting.

**luster:** The reflective quality, shine or sheen of a specific surface. When referring to textile materials, the term applies to the reflective quality of the surface of a yarn or fabric, frequently associated with the adjectives bright or dull.

**metallic:** Fiber or yarn composed partially of metal or metal-like components that create a highly reflective surface effect that can influence the color of a textile.



**master sample:** The reference against which color evaluations are made.

**metamerism:** The color shift that occurs between two samples of the same material in which colors are identical under some lighting conditions but not under others.

**mono-chromatic:** Visual perception of a single color that could be derived from a combination of different shades, tints, or tones or variations of these.

**optical brightener:** A colorless compound that absorbs ultraviolet rays from light and emits them in the visible spectrum. Optical brighteners are applied to fabric and yarns primarily to enhance whiteness.

**primary light source:** The designated light setting (source of light) agreed upon between parties to evaluate color.

**reverse crocking:** When dye from another source, such as apparel, transfers onto an interior furnishings material.

**shade band:** A group of physical samples exhibiting an acceptable color range to be used for the approval of future production.

**shading:** A light to dark variation of a given color that produces a subtle difference within an overall coloration.

**spectrophotometer:** A precision instrument used to measure the relative intensities of wavelengths in the spectrum.

**standard:** The reference against which color evaluations are made.

**top dyeing:** The process of covering a material with an additional dye, not necessarily of the same color or class, to obtain a desired shade. Also known as over dyeing. This process affects the repeatability of a color from dye lot to dye lot.

**value:** A term that expresses the lightness and darkness of a color. Value is the characteristic that describes the color as lighter (brighter) or darker (duller). Value is expressed by numbers 2 to 9 on a scale of 1 to 10 in which 1 is an ideal black and 10 is an ideal white. Accordingly, when two colors have the same hue but different value numbers, the higher value number is the brighter color.

**visual color evaluation:** Using the human eye for color comparison.

## Links

**AATCC:** American Association of Textile Colorists & Chemists. The AATCC is a longstanding, technically oriented professional association offering a broad range of workshops, textile links, and exchange of professional knowledge. [www.aatcc.org](http://www.aatcc.org)

**BIFMA:** Business Institutional Furniture Manufacturers Association. BIFMA is a North American trade association that represents the interests of business furniture manufacturers and their suppliers. [www.bifma.org](http://www.bifma.org)

**Colorcurve System:** An international company that provides products to help people throughout a broad range of industries select color, finish, and texture with confidence. [www.colwellind.com](http://www.colwellind.com)

**Color Marketing Group:** CMG is a non-profit international association of color designers dedicated to identifying color direction in design trends. Members interpret, create, forecast, and select colors in order to enhance the function, salability, and/or quality of products. [www.colormarketing.org](http://www.colormarketing.org)

**Cotton Incorporated:** An industry organization promoting the use of cotton in everyday lifestyle applications. The organization's Apparel Color Trend Forecast (ACTF) and SCOTDIC Cotton Colors for home furnishings are of special interest. [www.scotdic.com](http://www.scotdic.com) [www.cottoninc.com](http://www.cottoninc.com)

**Farnsworth-Munsell:** (See X-Rite.) A leader in Color Vision Analysis and Color Testing for a broad range of industries, including ophthalmology. [www.munsell.eu](http://www.munsell.eu)

**General Electric:** Lighting glossary. [www.gelighting.com](http://www.gelighting.com)

**Gretag-MacBeth:** (See X-Rite.)

**Hunter Lab:** A supplier of precision instruments (such as light boxes and spectrophotometers) and services that provide "real world" applications. [www.hunterlab.com](http://www.hunterlab.com)

**International Color Consortium:** ICC is a broad-based organization that is developing open, vendor-neutral, cross-platform solutions to color management. [www.color.org](http://www.color.org)

**Pantone:** Pantone is a multifaceted organization specializing in color matching systems, color planning, forecasting, and color management, as well as software, research, testing, and psychological insights affecting color. [www.pantone.com](http://www.pantone.com)

**Natural Colour System (NCS):** A multifaceted organization that addresses the scope of color communication and offers a variety of tools and educational products and services. NCS is wholly affiliated with the Scandinavian Colour Institute, AB, established in 1946 as an international center of color study. [www.ncscolor.com](http://www.ncscolor.com)

**X-Rite:** A provider of hardware (such as light boxes and spectrophotometers), software, and support solutions that ensure color accuracy and data communication. [www.x-rite.com](http://www.x-rite.com)