THE SECOND C: Blocking & Tackling, Part 1

By Keith Hoover

> ***"Todo saldrá en la colada."***
> ***[It all comes out in the wash.]***
> —Miguel de Cervantes, *Don Quixote*

Everyone who has done the laundry has learned to separate whites from colors (or darks from lights)—sometimes, the hard way. And those pitiable few who have actually read a care label are directed to wash a garment with "like colors" along with a recommended water temperature. But why go through the hassle?

Well, Cervantes' observation in *Don Quixote* answers the question with perhaps the earliest apparel care label instructions—indeed, it all comes out in the wash. The purpose of laundering is to refresh and renew a garment by removing dirt (and perhaps adding an optical brightener to "brighten" the garment). However, when dyes leave a garment and redeposit elsewhere in the wash load, the resulting stained garments can become unusable (at least to those who are self-aware). If a white shirt is laundered together with a red garment, the result might be a pink shirt.

So, we wash whites with whites, reds with reds, etc. But what do we do if a garment is constructed of mixed color panels—especially those breaking the "laundry sorting rule"?

COLOR BLOCKING ON POLYESTER

Mixing different color fabrics (especially colorful and white fabrics) in the same garment is known as "color blocking." Since *AATCC Review* is a publication for textile professionals, we can solve the problem posed by laundering mixed colors by taking steps to prevent color contamination (or staining) of differently colored components. This article focuses on polyester performance apparel (garments worn by athletes) and athleisure products (garments worn by spectators).

BACKGROUND

Washfastness and color transfer are quality concerns for all garments, regardless of design. Solid color garments can "bleed" or lose color during laundering—and the problem posed is the staining of other garments in the wash. Color blocked garments are often designed using fabric components of different colors, thus making the problem of bleeding even more serious. If not properly specified, a color from one fabric can impact

the shade of a color on another fabric within the same garment, either through prolonged contact or as a result of the laundering process. Let's review the basics of applying color to fabric and establish some guidelines for fabric/color selection to prevent color contamination in color blocked garments made with polyester.

Adding Color to Fabric

Besides coating (colorants adhered with some type of binder to the surface of a fabric), color is applied to fabric in two ways—dyeing and staining.

Dyeing: Dyeing involves bonding molecules of a given dyestuff to the molecules of fibers making up the yarns in a fabric. Dyes penetrate inside the fiber as well as on the surface. Since strong chemical bonds are created between the dyestuff and the fiber, no binder is needed. Dyeing is thus a complex coloration process requiring specific dye chemical structures matched to the unique molecular structures of different fibers.

A "dyeclass" is a set of dyes with a common molecular structure that bond with specific fiber types (such as polyester, cotton, nylon, or acrylic). In short, the dyes in a given dyeclass will bond with one fiber type, such as cotton, but not with a different fiber type, such as polyester. The types of bonding discussed here are relatively permanent and thus provide superior colorfastness, depending on the specific dyestuffs selected.

Staining: Staining is related to specific characteristics of dyestuffs as well as how the dyes are applied. Steps in the dyeing procedure are designed to bond the dyes with the fiber ("exhaust" the dye from the water into the fabric), but not all of the dye in the bath forms that strong bond with the fabric (referred to as "fixing"). Unfixed dye has a weak bond for both the fabric and the water in the bath. Various steps are taken to remove it from the fabric (soaping, rinsing, reductive clear, etc.). Even after these steps, some unfixed—or residual—dye might remain on the fabric, which can cause staining during home laundering.

As a rule of thumb, unfixed dyes tend to stain the type of fiber they are designed to dye. In a solid color garment, any unfixed dye present is not seen. When the garment is washed, the unfixed dyes can transfer to other clothes in the washer (redeposition) or simply wash down the drain, depending on the unfixed dye's affinity (attraction) for other fibers in the load.

Additionally, performance stretch knits made with polyester might have a high elastane content. Although conventional elastane is not dyeable, unfixed disperse dyes used on the polyester tend to stain the elastane and might not be removed when rinsing after dyeing. If not removed, they can stain other garments when washed together.

This textile series will share technical insights and wisdom of AATCC members. The "Second C" series will focus on color. If you wish to contribute your own technical insights on topics of interest to AATCC members, contact Communications Director, Maria Thiry; thirym@aatcc.org.

THE COLOR BLOCKING CHALLENGE

The risk that residual unfixed dye will redeposit on a different color fabric within a single garment during laundering creates the color blocking challenge. Instead of a concern for how unfixed color might stain other garments, the problem is whether the unfixed dye will redeposit onto other colors in the same garment. So, color blocked garments should be made with fabrics composed of different fibers (thus different dyeclasses) to reduce the risk of staining. Additionally, fabrics should be selected such that dyes in their dyeclass demonstrate the least propensity to stain elastane as well as the fiber in the other fabric in the garment.

Polyester is the fabric of choice in both performance and athleisure wear. It has several attributes and properties that make it attractive (not the least of which are cost and availability). Color blocking is an attractive design feature in these categories, so does that mean that fabrics made with other fibers must be introduced into the BOM to avoid staining? Well, yes and no.

POLYESTER VS CD POLYESTER

From the US Federal Trade Commission's (FTC) regulatory point of view, polyester is polyester. But from a dyer's point of view, there are two distinctly different types of polyester. "Regular" polyester is dyed only with disperse dyes. CD (Cationic Dyeable) polyester has been modified to be dyed with basic dyes (basic, as in base versus acid). CD polyester can also be dyed with disperse dyes, although those colors do not build as well on CD polyester.

So, there are two variations of polyester, one of which can be dyed with two dyeclasses and the other only with one. This distinction allows us to solve the color blocking challenge by introducing a second fabric to avoid staining without changing the fiber content of the garment (from the FTC's perspective).

REGULAR POLYESTER/CD POLYESTER COLOR BLOCKING GUIDELINES

Color selection for color block garments presents a higher class of problem for designers. They must not only select the aesthetically correct colors for the garment, but they must also assign those colors to the correct polyester version. To do this, they must remember:

- Disperse dyes can stain regular polyester, but not CD polyester; disperse dyes stain elastane
- Basic dyes can stain CD polyester, but not regular polyester; Basic dyes are less likely to stain elastane

With those two facts, they can rule the color blocking world.

If a brown regular polyester panel is sewn to a white regular polyester panel in a color blocked garment, there is a risk that unfixed dyes from the brown panel would stain the white fabric as a result of laundering. However, by merely assigning the brown shade to CD polyester and leaving the white panel as regular polyester, they could eliminate the problem because basic dyes don't stain regular polyester.

Depth of shade and polyester type (thus dyeclass) should be considered when designing color block garments. The darkest color should be applied to the type of polyester that has the least likelihood of staining the other type of polyester. Unfixed basic dyes are more easily removed after the dyeing process and thus, less likely to stain elastane. Unfixed disperse dyes are more difficult to remove after the dyeing process and present a greater risk to stain elastane. Thus, the best way to assign colors to color blocked garments is to use regular polyester and CD polyester fabric, applying the dark or bright shades to the CD polyester (see the Color Blocking Cheat Sheet).

SEEING RED

It is important to follow these guidelines when color blocking deep, bright shades to white, but even more so when color blocking red to white. And there is a perceptual reason for this. If we use only regular polyester fabric when color blocking blue to white and the white is slightly stained blue, we don't "see" a huge problem (although it's still unacceptable) because white shades with a blue cast are seen as "whiter." In fact, there was a time when "bluing" (an additive with a blue tint) was added when laundering whites to make them "whiter." Staining of white garments with most other shades merely makes them appear dirtier. But white fabric with a red stain changes our color perception altogether. Instead of seeing it as "bright" or "dirty" white, the white portion transforms to pink—a distinctively different (and arguably more objectionable) color. So, even when combining red regular polyester with a stain rating of 4 (or even 4.5) with white regular polyester in a color blocked garment, customers will likely see red (or pink) after laundering.

THE FABRIC SPECIFICATION CHALLENGE

Oh, it's that easy? Well, yes, as far as color specification goes. But, in order to have a CD polyester version of a fabric made with regular polyester yarn, the mill has to develop a new fabric (referred to as a fabric style or mill article number) that replicates the appearance and performance of the original. Remember, each fabric a mill makes is like a separate product that must include a specific build spec and performance history. When you ask for a variation of any fabric, the mill must get to work developing an acceptable sample—not just to send to you for your assessment—but to derive and nail down all of the knitting parameters to consistently produce that fabric, including a yarn spec, stitch density courses per inch (CPI), wales per inch (WPI) the stitch pattern repeat, the feed and cam layout repeat, the needle layout repeat, along with machine specific settings (tension, etc.). And each unique fabric requires a separate color approval (unless you're a color accreditation program (CAP) brand).

It's not merely a matter of swapping out yarns, since the mill must check out all the parameters and make sure the finished CD polyester fabric adequately replicates the regular polyester version. There are some nominal differences (other than the associated dyeclass) between the two. CD polyester is dyed at a lower temperature and might be softer and more absorbent than regular polyester.

From a brand's perspective, it makes sense to work with mills that have regular polyester and CD polyester versions of fabrics that are likely to be used in color blocked designs. Keep the fabric variations to a minimum because each fabric development request is actually two fabric development requests (and two color approvals). And don't allow a sourcing person to start mixing and matching fabric versions from different mills. Keep it simple.

COLOR BLOCKING CHEAT SHEET

Colorways Requiring Regular Polyester and CD Polyester:

Bright or medium/dark colors (especially red shades) to white

- The bright or medium/dark colors should be assigned to the CD polyester
- White should be assigned to the regular polyester

Dark colors to light colors

- The dark color should be assigned to the CD polyester
- The light color should be assigned to the regular polyester

Bright colors to dull colors

- The dull color should be assigned to the CD polyester
- The bright color should be assigned to the regular polyester

Colorways Requiring Only Regular Polyester:

Low contrast colors with comparable brightness or dullness

- Dark to dark
- Medium to medium
- Light to light
- Light to medium (non-red) colors to white

COLOR BLOCKING TEST

Assign the correct polyester version to each color in the colorway.

1

a) Olive: Reg poly, Orange: Reg poly
b) Olive: Reg poly, Orange: CD poly
c) Olive: CD poly, Orange: CD poly
d) Olive: CD poly, Orange: Reg poly

2

a) Gray: Reg poly, Amber: Reg poly
b) Gray: Reg poly, Amber: CD poly
c) Gray: CD poly, Amber: CD poly
d) Gray: CD poly, Amber: Reg poly

3

a) Red: Reg poly, White: Reg poly
b) Red: Reg poly, White: CD poly
c) Red: CD poly, White: CD poly
d) Red: CD poly, White: Reg poly

4

a) Turquoise: Reg poly, Green: Reg poly
b) Turquoise: Reg poly, Green: CD poly
c) Turquoise: CD poly, Green: CD poly
d) Turquoise: CD poly, Green: Reg poly

5

a) Pink: Reg poly, Red: Reg poly
b) Pink: Reg poly, Red: CD poly
c) Pink: CD poly, Red: CD poly
d) Pink: CD poly, Red: Reg poly

6

a) Blue: Reg poly, Citrene: Reg poly
b) Blue: Reg poly, Citrene: CD poly
c) Blue: CD poly, Citrene: CD poly
d) Blue: CD poly, Citrene: Reg poly

7

a) Citrene: Reg poly, Black: Reg poly
b) Citrene: Reg poly, Black: CD poly
c) Citrene: CD poly, Black: CD poly
d) Citrene: CD poly, Black: Reg poly

8

e) Black: Reg poly, Gray: Reg poly
f) Black: Reg poly, Gray: CD poly
g) Black: CD poly, Gray: CD poly
h) Black: CD poly, Gray: Reg poly

9

a) Black: Reg poly, Yellow: Reg poly
b) Black: Reg poly, Yellow: CD poly
c) Black: CD poly, Yellow: CD poly
d) Black: CD poly, Yellow: Reg poly

10

a) Red: Reg poly, White: Reg poly
b) Red: Reg poly, White: CD poly
c) Red: CD poly, White: CD poly
d) Red: CD poly, White: Reg poly

11

a) Blue: Reg poly, Lt Blue: Reg poly
b) Blue: Reg poly, Lt Blue: CD poly
c) Blue: CD poly, Lt Blue: CD poly
d) Blue: CD poly, Lt Blue: Reg poly

12

a) Purple: Reg poly, White: Reg poly
b) Purple: Reg poly, White: CD poly
c) Purple: CD poly, White: CD poly
d) Purple: CD poly, White: Reg poly

FROM BLOCKING TO TACKLING

In this article, we discussed using two different versions of polyester as fabric components that are combined in a single garment. In the next issue, we will tackle mixing regular polyester and CD polyester fibers together to make multicolor yarns, which in turn are knitted into complex fabrics (heathers, mélange, etc.). We will cover how to specify those yarns and fabrics and even formulate and assess their color digitally.

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Color Blocking Test Answer Key

1.	D	4.	A	7.	B	10.	D
2.	D	5.	A	8.	A	11.	A
3.	D	6.	D	9.	D	12.	D

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- Hoover, K. The Second C: From Inspiration to Replication. *AATCC Review*, **2022**, *22* (2), 28-32.
- Hoover, K. The Second C: Lab Dips—The First Circle of Hell (Part 1). *AATCC Review*, **2022**, *22* (3), 26-30.
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- Hoover, K., The Second C: Observer Metamerism, *AATCC Review*, **2025**, *25* (4), 26-31.
- Hoover, K., The Second C: An Interview with Chris Sargeant *AATCC Review*, **2025**, *25* (5), 24-30.