We End Where Others Start: Color Consistency-Maintained
Color Inconsistency

Research has shown that lighting color quality is the key element of customer satisfaction; 
*maintained consistency is a key color quality.*
The ability of a light source to maintain its original color properties over time is commonly referred to as “Color Maintenance”.

Color Consistency-Maintained?
Causes

Luminaire materials change over time:

- LEDs
- Phosphors
- Lenses
- Reflectors
- Coatings
Research and Standards

No standards exist on acceptable color change over time.

Unlike IESNA TM-21, there are no industry standards to predict long term color maintenance.
Challenges of Predicting Color Change

Everyone’s LED product behaves differently.

Manufacturers change product over time.

Manufacturers have limited reliability data.
Xicato and Color Consistency

We care
Color, consistency and quality of light are part of our core values.

We developed a technology
Corrected Cold Phosphor Technology®

We established a Product Data Sheet Specification
C3/50,000 hrs.

We introduced the industry’s first color consistency warranty
<.003 ∆ u’,v’ for 5 years.

Xicato XSM
Remote Phosphor
Every Xicato module is designed to maintain its original color point below 0.003 points in \( u', v' \) (CIE 1976) for 50,000 hrs.
Basis for the “3” as in \(0.003 \Delta u', v'\)

< 3 is recognized to be “just noticeably different”

7 Step
Energy Star initial and 6,000 hr. requirement

1 x 2 Step
Xicato Initial Spec

3 Step
Xicato Maintained Spec. is less than 3 SDCM
Reliability Data

Xicato Product Data Sheet Specification

Time in Hours

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

Energy Star
Unit A
Unit B
Unit C
Unit D
Unit E
Unit F
Unit G
Unit H
Unit I
Unit J
Unit K

Δu'v'
Color Consistency- Maintained

- Color change examples:
  - Consistent, but new color point (A).
  - Inconsistent color points (B)

- Ensuring that (B) does not occur is most important.
Warranty – No Fine Print

Modules are warranted against a difference of < .003 $\Delta u',v'$ for 5 years.
Mitigating the Risk of Color Inconsistency

- Understand the lifetime of all components:
  - Light source, reflectors, and lens optics.

- Obtain 2\textsuperscript{nd} party validation of luminaire:
  - Xicato offers a free Thermal Validation Program.

- Design the luminaire to be easy to service in the field:
  - Tool-less serviceability of power supply, reflector and LED module assembly.
Color Consistency- Maintained

Example
CIE 1976 Color Space (u’, v’)

3000K

2-Step
3-Step
Warmer color temperature (CCT) along the “black body locus”...
Cooler temperature along the black body locus...
Above the black body locus...
Below the black body locus
Color Consistency- Initial (<2 SDCM)
Color Consistency - Maintained (<3 SDCM)
“Just Noticeable Difference”
Color Consistency - Maintained (<3 SDCM)

“Just Noticeable Difference”
Color Consistency- NOT Maintained

(Energy Star acceptable at 6,000 hrs. = 7 SDCM)