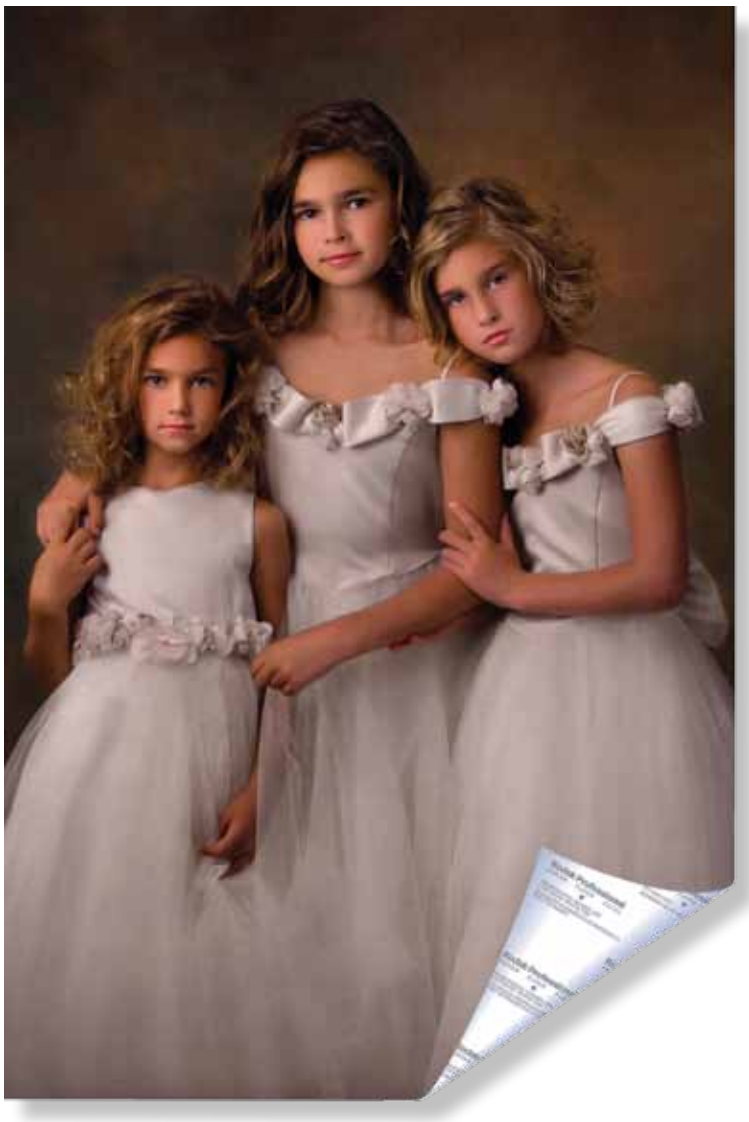
Kodak Professional Endura
Premier Paper

White Paper

IMAGE PERMANENCE



Introduction

Why make prints when we have our computers, tablets and smartphones? After all, these viewing devices create vivid images of the digital files that have been captured. There are two strongly compelling reasons consumers will make prints from digital images:

- Creation of a tangible, physical reality
- Long-term preservation of the image

Prints of digital files can be produced using a variety of output technologies, including the traditional silver halide photographic process and the electrophotographic (EP) process.

Kodak Alaris continually evaluates the image permanence performance of both Kodak Alaris products and competitive products, continuing a long tradition of providing the photographic industry with best-in-class image permanence for our silver halide papers. The data and conclusions published from these image permanence testing techniques have been trusted by photographers, labs, and the photographic industry worldwide for decades. In addition, Kodak Alaris utilizes independent third party testing to verify test results.

Light Stability

The light stability performance of prints displayed in typical home environments is a key factor. Kodak Alaris' silver halide prints consistently perform well when compared with prints made using EP digital presses. It is critical that the test conditions represent the type and intensity of illumination found in homes where prints are typically displayed. In the home, prints may be unlaminated, laminated, or placed behind glass for display.

EP digital press manufacturers often overstate light stability performance, as the tests they perform do not account for illumination used in a typical home display environment.

The type and intensity of illumination used for testing light stability is critically important to the validity of the test results. Other manufacturers typically test light stability using high intensity illumination to expedite test results. This testing alone will not consistently predict what will be seen under typical home display lighting conditions, which have significantly lower illumination levels. Kodak Alaris test procedures include high intensity illumination and low intensity illumination to best replicate typical home display lighting conditions. The test methodology that Kodak Alaris employs has been used for decades and has consistently demonstrated more accurate print life estimates than high intensity testing alone.

In comparison, often the test conditions used for testing prints made using EP presses (like the testing conducted by Wilhelm Imaging Research, Grinnell, Iowa for prints made using the HP Indigo Digital Press) only use high intensity testing which does not give accurate print life estimates because it ignores the failure of reciprocity law that results in faster fade under lower illumination[1]. In addition, they only test using fluorescent lighting. It has been documented that UV-filtered Xenon-light is a closer match to the "typical" illumination in an average home[2].

At Kodak Alaris, our high-intensity and low-intensity test procedures expose sets of samples to both filtered fluorescent light and filtered Xenon light. Published data has verified that the spectral distribution of light from a filtered Xenon source more closely replicates the spectral distribution of light in typical home display lighting conditions[2]. When tested using simulated indoor home lighting as defined by the ISO standard on measuring indoor light stability[3], the light stability performance of KODAK PROFESSIONAL ENDURA Premier Paper is similar to the performance of prints produced using the EP digital press with liquid inks. In addition, the fade rate for EP prints will be higher under low-intensity lighting conditions (for example, typical home display lighting) than the high-intensity accelerated display conditions often used by other manufacturers.

If the testing is performed under conditions that don't represent typical home display lighting conditions, the conclusions which are drawn from this data may not be accurate. Kodak Alaris always adheres to the established ISO protocol in an effort to best reproduce the way customers use and display their prints in their home environment.

Light Stability Testing

Light Source	Illuminant Level	Kodak Alaris	Most Testing Sites
Fluorescent	High Intensity	Yes	Yes
	Low Intensity	Yes	No
Xenon	High Intensity	Yes	No
	Low Intensity	Yes	No

Typical home display lighting conditions are best represented by low intensity filtered Xenon light. Kodak Alaris uses this testing methodology, most others do not.

Kodak Alaris has concluded that prints produced using KODAK PROFESSIONAL ENDURA Premier Paper have similar print life performance in typical home display environments when compared with prints made using the EP digital press with liquid inks.

Dark Stability

Because a large percentage of photographic prints will be stored in dark conditions (for example inside a closed photo album or box), the dark stability performance of prints is also very important. Kodak Alaris has made the following conclusions regarding the dark stability and environmental gas (ozone) image permanence performance of both silver halide prints and EP prints:

1. Without post-printing lamination, EP prints made using liquid inks have significant ozone sensitivity. Ozone exposure can significantly deteriorate the image over time. Lamination is not required for silver halide prints to protect the image from ozone degradation. Dark stability of unlaminated EP prints > 100 years is unlikely. KODAK PROFESSIONAL ENDURA Premier Papers have a documented life of >200 years dark stability[4].
2. Without post-printing lamination and depending on the substrate used, EP prints are prone to D-min (minimum density) yellowing as a result of exposure to heat and /or light. Post-printing lamination will eliminate the yellowing of D-min resulting from light exposure; however, the D-min will continue to yellow over time as a result of heat exposure.

Summary of Image Permanence Performance

KODAK PROFESSIONAL ENDURA Premier Paper

Light Stability (for example, a print displayed in a typical home environment):
EP prints do not have a significant advantage over prints produced using KODAK PROFESSIONAL ENDURA Premier Paper in typical home display environments.

Dark stability (for example, prints in a closed album stored in a typical home environment):
Prints produced using the EP press and liquid inks which are not laminated after printing will degrade significantly more when compared with prints produced on KODAK PROFESSIONAL ENDURA Premier Paper. This disadvantage of unlaminated EP prints due to the demonstrated ozone sensitivity is significant.

Image Stability Performance

Print Type *(Unlaminated)*	**Light Stability** *(Typical Home Display Conditions)*	**Dark Stability** *(Ozone Stability of Liquid Inks)*	**D-min Yellowing** *(Heat and/ or Light Sensitivity)*
Traditional Silver Halide Prints	Similar	Advantaged	Advantaged
Electrophoto-graphic (EP) Prints	Similar	Disadvantaged	Disadvantaged

[1] D.E. Bugner, D. Kopperl, and P. Artz, Proc.12th Int. Symp. on Photofinishing Technology, pp. 54–57 (2002).

[2] The illuminant choice and light intensity levels are based upon data on published scientific data (D. Bugner, J. LaBarca, et al., "A Survey of Environmental Conditions Relative to the Storage and Display of Photographs in Consumer Homes", Journal of Imaging Science and Technology, 50 (4), 2006, PP. 309-319.)

[3] "ISO Publication 18937:2014 Imaging materials – Photographic reflection prints – Methods for measuring indoor light stability".

[4] KODAK PROFESSIONAL ENDURA Premier Paper - Kodak Alaris Technical Publication E-4070 , 2014.

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www.kodakalaris.com/go/endura