

Print Permanence

An Epson White Paper

Overview

How long will a photographic print last? There is no simple answer. But it is important for anyone who cares about their photos to have a base understanding of the factors that affect the longevity of prints to make informed decisions and insure those photographic prints will last an expected time.

This white paper deals with the complex subject of print permanence and how knowledge of industry-accepted comparative print permanence testing can lead to the best decisions about buying or specifying imaging products. Every bit as important, this document will help the reader detect potentially misleading marketing claims about photographic image quality, print permanence and the limitations of universal compatibility.

We at Epson want to help consumers and professionals learn more about how prints are made and how different inks and papers can help create not just memories but high quality memories and works of art that will look good not only today but also to future generations.

A Brief History of Print Permanence

Toward the end of the 19th century most photographic images were captured with sensitized silver salts coated on cumbersome glass plates. After exposure to light, the plates were chemically developed which formed a reversed or negative image, hence the term "negative." After the negative image was "fixed," the photographer created a positive print by individually contacting the negative with a sensitized paper which was then chemically developed. The process was complicated, and expensive, and amateur photographers were few.

In the late 19th century flexible roll film became commercially viable. This film, which could be transported through smaller, more portable hand-held cameras, allowed users to make numerous exposures. With no heavy, rigid, breakable glass plates involved, producing photographic prints became relatively easy. Soon non-professionals took up photography.

As photography became widespread, people recognized the intrinsic value of photographs in documenting their times and in preserving cherished memories for themselves and future generations. The photographic print became and still is a most valued personal possession. During times of natural disasters, heroic efforts are often made to save photographic prints because while most material possessions can be replaced, photographic prints are in many cases unique and cannot be replaced. When a print is lost, copies are often impossible to make because the original negatives are either damaged or in many cases simply lost.

It is also clear that most photographic prints will have greater longevity than a computer hard drive or magnetic media. Not only can digital storage devices be damaged by magnetic fields, viruses and equipment malfunction, but rapid changes in technology tend to make the devices and their file formats obsolete. In addition, many back-up digital storage systems such as CDs and DVDs incorporate materials that may fade or change in ways that could make their contents unreadable in the future.

From the beginning of the 20th century until the 1950s most photographic prints were in black and white. If properly processed, these fiber based black and white prints had and still have great resistance to fading from light or gas and to water damage. Because of the high inherent stability of fiber based black and white prints, many of these early photographs remain in excellent condition and even now reside in family collections, commercial collections and museums.

Because consumers and professionals had not experienced significant fading with the properly processed black and white prints they received from a lab or developed themselves, when color prints were introduced in the late 1950s, they had no reason to suspect that new color prints might fade. The leading photographic manufacturers of the time settled on dye-based systems as the only feasible way to bring color photography to the marketplace. Unfortunately these dye-based photographic materials had significantly less print permanence than those in existing black and white films and prints. As they competed for adoption and market share, manufacturers of this time put little effort into making this information available. By the 1970s and '80s most of those cherished memories, important historical records and purchased photography in color had not only faded, but sometimes had virtually disappeared, even when the film and paper used were from the leading brand.

Almost everyone has had a disappointing experience with the rapid fading or loss of color in their traditional prints. However, few people understand the nature of print fading and the options that enhance permanence that are available to them today. People want their photos to last for generations. We at Epson are trying to make that desire a reality.

Basics of Print Permanence

The subject of image stability of color photographs has become considerably more complex in the last decade. In the past, most color prints were produced by labs or service providers using a chemical-based analog process with materials obtained from just a few manufacturers. The number of companies producing traditional sensitized materials remains few, but there are significant print permanence differences in these products that can be measured.[1] Unfortunately few consumers know there are differences and that they have choices.

WIR Print Display Permanence Ratings

[1] Type of Silver-Halide Paper		WIR v3.0 Endpoint at Both 1.0 and 0.6 Densities Cool White Fluorescent Illumination Years of Display Based on 450 lux/12hrs/day Prints Framed Under Glass
Fujicolor Crystal Archive Type One Paper (silver-halide color prints) <ul style="list-style-type: none"> Printed with Fuji Frontier Digital Minilab and Fuji washless chemicals 	40 years	
Kodak Edge Generations and Royal Generations Paper (silver-halide color prints) <ul style="list-style-type: none"> Printed with Noritsu Digital Minilab and Kodak washless chemicals 	19 Years	

As photography moved into the digital age and as more companies entered the business, the industry developed predictive print permanence tests that give better insight into how all prints, especially those displayed in light, will look to future generations. But if any manufacturer makes compromises to print permanence testing methods that artificially inflate longevity predictions, a new generation of consumers may see their precious memories fade, just as they have in the past. No photographic print can last forever, but responsible companies like Epson are continually striving to improve the permanence of inks and papers so that photographic prints can last for generations even when displayed and exposed to light.

The past decade has seen a significant increase in the number of images produced with digital printers by both professionals and consumers. The number of output devices has increased dramatically, and the different materials being used vary widely in both their composition and response to environmental factors. To make informed decisions, it is critical to recognize confusing apple-to-orange comparisons and to beware of sweeping claims of universal compatibility. Both may adversely affect image quality or print permanence or both.

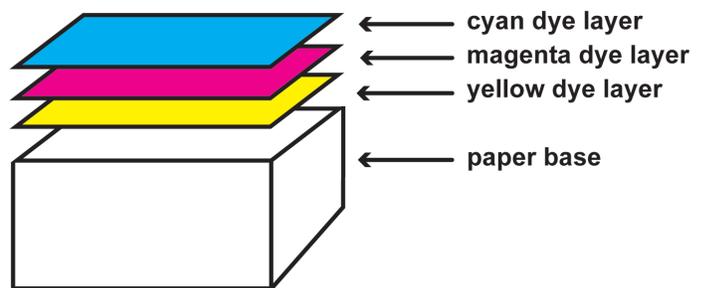
[1] See: *WIR Display Permanence Ratings for Current Products in the 4x6-inch Printer Category*, Wilhelm Imaging Research, Inc., December 7, 2004, available at www.wilhelm-research.com

The three primary technologies in use today to produce color photographic prints are:

- Traditional Silver-Halide
- Dye Sublimation
- Inkjet

Traditional Silver-Halide Color Photographic Prints

Until the 1990s almost all color prints were made with light sensitive materials that incorporated color dyes in an emulsion adhered to a paper which was sealed by a plastic coating. In normal practice, these prints are made by first creating a negative image with a camera and color negative film. The negatives are then used to print a positive image on a silver-halide sensitized paper. A traditional silver-halide color print can also be made from a digital file. Instead of exposing the sensitized paper with white light passing through a negative via an optical enlarger, a laser or an LED exposes the paper. It is important to note that regardless if the print was exposed with a laser or with a traditional optical enlarger, the permanence characteristics of a silver-halide color print remain the same. If stored in the dark, with low humidity, traditional silver halide prints may last from 50 to more than 100 years. If exposed to light, the colors will deteriorate at a more rapid pace. This deterioration will vary widely between manufacturers' products and the levels of illumination and ultraviolet light to which a print has been exposed.[2]

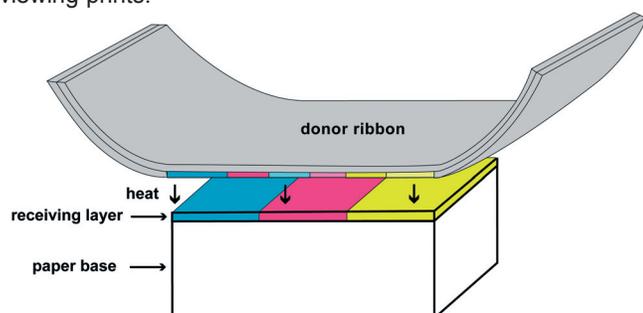


Cross-section of traditional silver-halide color paper

[2] Henry Wilhelm and Carol Brower (contributing author), *The Permanence And Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures*, Preservation Publishing Company, Grinnell, Iowa, 1993. This 758-page book is now available in PDF format at no cost from www.wilhelm-research.com

■ Dye Diffusion Thermal Transfer Prints (Dye-Sub Prints)

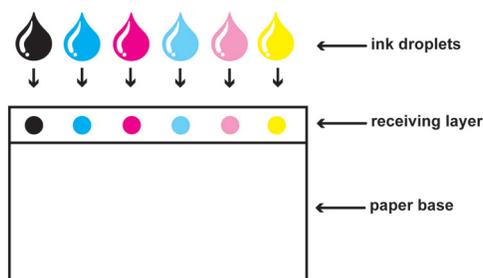
In this process files generated from digital cameras or scanned negatives, transparencies or traditional prints are sent to a printer where heat transfers colorants from a donor ribbon to the final print. Today most dye diffusion thermal transfer printers apply a clear protective layer to the print during the transfer process to ensure water resistance and to prevent smearing and staining when rubbed or handled. This protective layer provides relatively little protection against the effects of light. When exposed to well-lit display conditions suitable for the enjoyment of photographs, the permanence of these prints is generally not very good. [3] Usually claims of exceptional lightfastness for dye-sub prints assume dark storage or such very low light conditions that most people would consider the illumination inadequate for viewing prints.



Cross-section of donor and receiver system

■ Inkjet Prints

As with dye-sub printers, files generated from digital cameras or scanned negatives, transparencies or traditional prints are sent to an inkjet printer. The majority of photo-quality printers use inkjet technology in which very small droplets of ink measured in picoliters (trillionths of a liter) are deposited onto paper. Inkjet print stability varies widely based on the composition of the colorants used in combination with the particular paper selected. Many combinations are available. [4]



Cross-section of coated inkjet paper

[3] See: *WIR Display Permanence Ratings for Current Products in the 4x6-inch Printer Category*, Wilhelm Imaging Research, Inc., December 7, 2004, available at www.wilhelm-research.com

[4] See: Anush Yeghazarian, "The Fade Factor," *PC World*, pp. 18-, San Francisco, California, November 2002, and Dan Littman, "Cheap Ink Probed", *PC World*, pp. 22-, San Francisco, California, September 2003.

Dye Inks and Pigment Inks

Inkjet manufacturers either use dye-based inks that are similar in some respects to those used in traditional photographic prints and/or they use pigment-based inks similar to the colorants used in automotive paints. In the past the majority of inkjet printers utilized dye-based inks, which at the time had a significantly wider color gamut than pigment-based inks. This wider color range produced excellent quality prints with more vivid colors. At the same time, pigment-based inks which have excellent longevity characteristics were primarily used in conjunction with one or two specialty papers or media for specific non-photo applications, such as outdoor signage, because of the limited color gamut.

In the past several years, Epson developed a unique micro-encapsulated technology for pigment-based inks in which each pigment particle is coated in resin, yielding an increased color gamut while retaining the excellent longevity characteristics of pigment inks. This technology has resulted in an inkset called UltraChrome K3™, which has become the de-facto standard for the most discerning professional photographers who seek the highest image quality combined with the greatest print permanence. Epson also markets a similar micro-encapsulated pigment inkset for consumers called DuraBrite® Ultra. In general, pigment-based inks have greater lightfastness, greater resistance to ozone, and greater resistance to humidity and water than dye-based inks. In addition, UltraChrome K3 inks deliver outstanding image quality and print permanence on a wide variety of papers, allowing end-users more flexibility and greater creative expression. Other manufacturers may promote a single ink and media combination that achieves a high lightfastness rating; but this high rating is often achieved with only one or two specific papers, and the prints, especially those made with a swellable paper, may be susceptible to damage with normal handling.

Papers

Inkjet prints can be made on a wide variety of coated papers. High quality photographic prints are often made with coated papers in the following categories:

- Swellable
- Porous
- Cotton Rag

■ Swellable Paper

As its name implies, the surface of this type of coated inkjet paper swells in the presence of the moisture in the ink, allowing colorants to penetrate the top layers. Swellable papers typically have three layers: a protective top layer; a layer that fixes the ink droplets in place; and below that, a layer that absorbs additional ink components. The paper base is sandwiched between two polyethylene layers (similar to traditional silver-halide RC photographic papers) and backed by an anti-curl coating and an anti-static layer.

The polymer coating on swellable papers not only acts to stabilize the inks by keeping the dyes from spreading, it also helps protect the image from fading due to light and atmospheric pollutants. However images printed on swellable paper often require extended drying times and are susceptible to image degradation caused by exposure to water, moisture via fingerprints and residue from a variety of vapor sources such as sneezes, cooking fumes and aerosol sprays. Swellable papers are generally suitable only for dye-based inks. Contrary to one-size-fits-all marketing claims made by some manufacturers, the use of a swellable paper produces poor image quality with pigment-based ink because the pigments are not totally absorbed into the swellable ink receptive layer. This type of ink and media mismatch produces prints that not only suffer in image quality, but that rarely dry properly. For example, Eastman Kodak promotes its swellable Ultima paper for use with both pigment-based or dye-based inks [5], but Epson's internal tests and reports from customers show that this relatively expensive paper marketed as a product to improve quality actually yields poor image quality when combined with Epson's UltraChrome K3 or DuraBrite Ultra pigment inks.

■ Porous Paper

The surface of a porous paper is coated with microscopic inert particles that create cavities in which ink is deposited. These cavities prevent the ink from spreading. Porous paper has a higher resistance to moisture and humidity and is often referred to as "instant dry paper."

As a result, these papers require minimal drying time, so the print can usually be handled immediately with less concern about smudging. However, because this type of print has no protective polymer layer, the colorants are susceptible to attack by atmospheric pollutants such as ozone and oxides of sulfur and nitrogen. Porous paper is the preferred paper to use with pigment-based inks, which are less affected by atmospheric contaminants than dye-based inks. In addition, pigment-based inks generally have much better lightfastness characteristics and ozone resistance on porous papers than dye-based inks.

■ Cotton Rag Paper

100% cotton fiber matte coated papers are most suitable for fine art printing. Cotton papers are generally acid free and lignin free. Some manufactures add alkaline buffers to cotton papers for increased protection from atmospheric contaminants. When used in conjunction with pigment-based inks, these papers provide excellent image quality and the longest overall print life on the market.

Challenges of Print Permanence Testing

Consumers can evaluate inkjet prints for image quality and for handling characteristics such as resistance to scratches, moisture, smudging, folding and tears, but comparative print permanence testing is the only way to predict how environmental factors will affect a print over time. The key environmental factors that impact prints include:

- Light
- Dark Keeping
- Temperature and Humidity
- Gaseous Pollutants
- Water

■ Light

Exposure to light was and continues to be the leading cause of fading with traditional silver-halide color prints. It is important to remember that different silver-halide print products from the same or different manufacturers fade at different rates. Inkjet prints made with dye-based inks or pigment-based inks are also susceptible to light fading, but at different rates. In addition the paper used will affect the rate of fade and different grades of dyes will yield significantly different results both for color reproduction and lightfastness. When compared under equivalent test conditions, inkjet prints made with pigment-based inks and printed on papers designed to react favorably with them yield significantly better lightfastness than do most dye-based inkjet prints. They will also last longer when displayed in well lit environments than will traditional silver-halide color prints.

Because the subject is complicated, users must exercise care when trying to understand how manufacturers position and promote claims of lightfastness. Manufacturers generally recommend only certain combinations of specific inks with specific papers. The use of other inks or other papers, even from the same manufacturer, can result in far lower protection from fading. Dye-based inks in particular typically achieve higher levels of lightfastness only with specific papers, while pigment-based inks offer greater resistance on a wide range of papers. Therefore, as explained below, caution should be used regarding sweeping print permanence claims for products such as Eastman Kodak's Ultima paper. Eastman Kodak uses significantly lower test criteria than industry accepted practices to achieve this rating.

[5] See www.kodak.com

■ Lux Levels

Lux is a unit of measure that indicates the quantity of light that falls on a surface.

The most widely accepted industry practice for accelerated lightfastness testing is exposure of photographic prints to glass filtered cool-white fluorescent illumination that simulates indoor display for 10 to 12 hours a day at a brightness level of at least 450 lux. This 450 lux or higher methodology has been accepted as a minimum by the large majority of manufacturers in the industry. Eastman Kodak has caused much confusion in the marketplace by basing its claims on a very low 120 lux level. At a minimum this level delivers 3.7 times less illumination than the industry accepted 450 lux or higher. The likely result is that users of Eastman Kodak products who expect their prints to last in displayed conditions may be disappointed over time. [7]

[6] “Standard” Indoor Illumination Levels
Used by Printer, Ink, and Media Manufacturers

120 lux/12 hrs/day	450 lux or 500 lux/10 hrs/day or 12 hrs/day
	Agfa-Gevaert** Fuji Hewlett-Packard Epson Canon Lexmark Ilford Konica-Minolta DuPont Ferrania InteliCoat Somerset Arches LexJet Lyson Luminos Hahnemuhle American Inkjet MediaStreet
Kodak	
AgfaPhoto*	

*AgfaPhoto GmbH (Germany)

**Agfa-Gevaert NV (Belgium)

[6] Filtration Conditions Used by Printer, Ink, and Media Manufacturers with CW Fluorescent Illumination

UV Filter	Glass Filter
	AgfaPhoto* Agfa-Gevaert** Fuji Hewlett-Packard Epson Canon Lexmark Ilford Konica-Minolta DuPont Ferrania InteliCoat Somerset Arches LexJet Lyson Luminos Hahnemuhle American Inkjet MediaStreet
Kodak	

*AgfaPhoto GmbH (Germany)

**Agfa-Gevaert NV (Belgium)

Eastman Kodak has been criticized for using a combination of other test methods to increase print permanence claims for all its products, whether they are silver-halide, dye-sub or inkjet. For example, in addition to a dim 120 lux light level, Eastman Kodak uses more intense exposure over a shorter period of time than do others in the industry. This practice potentially introduces higher levels of reciprocity failure, in which a print could be predicted to fade more slowly than would actually occur if it were exposed at lower illumination over a longer time period. Image degradation processes usually proceed slowly; therefore test duration is very important because faster acceleration produces less accurate results. Eastman Kodak also follows an unusual practice of providing print permanence ratings only with 100% ultraviolet (UV) filtration, which further compromises the integrity of their ratings because all photographic materials fade more rapidly in the presence of UV. Most companies provide permanence ratings based on testing with a glass filter (approximately 30% UV filtration) to simulate framing prints under glass. Some companies provide ratings with both a glass filter and a UV filter for customers who choose to frame with special UV resistant materials. With all these factors in play at once, Eastman Kodak is making display-life predictions for all its products including Kodak’s Ultima paper and its traditional silver-halide papers that are up to 5 times longer than if they relied on the more rigorous industry accepted tests. [7]

Using lesser standards, prints that have a lightfastness rating of 19 years based on comparative testing with industry accepted test practices could suddenly have a lightfastness rating of over 100 years with such low test criteria.

[6] See: Table 2 in “A Review of Accelerated Test Methods For Predicting The Image Life of Digitally-Printed Photographs – Part II,” by Henry Wilhelm, *IS&T’s NIP20: 2004 International Conference on Digital Printing Technologies*, pp. 664–669, November 1, 2004, available at www.wilhelm-research.com

[7] See Table 2 in *WIR Display Permanence Ratings for Current Products in the 4x6-inch Printer Category*, Wilhelm Imaging Research, Inc., December 7, 2004, available at www.wilhelm-research.com

WIR Print Display Permanence Ratings 4x6 Inch Photo Printer Category

[7] Type of Printer/Paper/Ink	WIR v3.0 Endpoint at Both 1.0 and 0.6 Densities Cool White Fluorescent Illumination Years of Display Based on 450 lux/12hrs/day Prints Framed Under Glass
1. Epson PictureMate Personal Photo Lab (pigment-based inkjet prints) <ul style="list-style-type: none"> Printed with Epson PictureMate Inks and PictureMate Photo Paper 	104 years
2. HP Photosmart 325 and 375 Compact Photo Printers (dye-based inkjet prints) <ul style="list-style-type: none"> Printed using HP Viverna Inks (HP No. 95 or No. 97 Tri-color cartridges) With HP Premium Plus and HP Premium Photo Papers, High Gloss, Glossy, or Soft Gloss HP Photosmart 325 and 375 B&W prints using HP No. 100 Gray Photo cartridge With HP Premium Plus and HP Premium Photo Papers, High Gloss, Glossy, or Soft Gloss Printed using HP Viverna Inks (HP No. 95 or No. 97 Tri-color cartridges) and Kodak Ultima Picture Paper, High Gloss (ColorLast "Lasts Over 100 Years" version) 	82 years
3. Fujicolor Crystal Archive Type One Paper (silver-halide color prints) <ul style="list-style-type: none"> Printed with Fuji Frontier 370 digital minilab and Fuji washless chemicals 	115 years
4. Kodak EasyShare Printer Dock 6000 and 4000 Printers (dye-sub prints)	26 years
5. Agfacolor Sensatis and Agfacolor Splendix Papers (silver-halide color prints) <ul style="list-style-type: none"> Printed with Agfa d-lab.2plus/Select digital minilab and Agfa washless chemicals 	40 years
6. Kodak Edge Generations and Royal Generations Papers (silver-halide color prints) <ul style="list-style-type: none"> Printed with Noritsu QSS-3011SM digital minilab and Kodak washless chemicals 	22 years
7. HP Photosmart 145 and 245 Compact Photo Printers (dye-based inkjet prints) <ul style="list-style-type: none"> Printed using HP No. 57 Tri-color cartridge with HP Premium Plus and HP Premium Photo Papers, High Gloss, Glossy, or Soft Gloss HP Photosmart 145 and 245 B&W prints using HP No. 59 Gray Photo cartridge With HP Premium Plus and HP Premium Photo Papers, High Gloss, Glossy, or Soft Gloss Printed with HP No. 57 Tri-color cartridge and Kodak Ultima Picture Paper, High Gloss (ColorLast "Lasts Over 100 Years" version) 	19 years
8. Konica Minolta QA Paper Impresa and Centuria For Digital (silver-halide color prints) <ul style="list-style-type: none"> Printed with Konica Minolta R2 Super 1000 digital minilab and Konica washless chemicals 	18 years
9. Olympus P-10 Printer (dye-sub prints)	115 years
10. Canon CP-200, CP-220, CP-330, CP400 and CP500 Printers (dye-sub prints)	11 years
11. Sony DPP-EX5, DPP-EX7, and DPP-EX50 Printers (dye-sub prints)	17 years
	8 years
	7 years
	4 years

Inconsistent testing practices generate considerable confusion for consumers who cannot then accurately compare the ratings for different brands of paper and ink with the ratings provided by the manufacturers of their printers. In addition, the lower test criteria lead to an escalation of print permanence claims to the point of absurdity. For example, under the forgiving test criteria used by Eastman Kodak, some Epson prints could be predicted to last longer than an incredible 1,000 years. Epson is opposed to giving credibility to such unrealistic claims. We believe users should be aware of test criteria that dramatically inflate print permanence ratings. We believe they should not trust their memories and/or reputations to products that are tested with overly lenient procedures rather than according to more accepted test practices.

■ Dark Keeping

While storage in the dark will generally increase the effective life of a photographic print, one should not assume that dark keeping will always produce greater longevity. It is important to know the effects of light on imaging materials or combinations of materials from different manufacturers. It is equally important to know how the very same materials will behave in dark storage. Some products may have dark keeping properties that are in hundreds of years but are rated only at 10-20 years when exposed to light; Therefore consumers should be particularly careful of any manufacturer making longevity claims based on dark keeping or album storage alone. Conversely it is possible, with the numerous permutations available from using ink and paper combinations made by companies other than the manufacturer of a printer, to produce a print that has good light stability but poor dark keeping.



Lightfastness Testing Chamber, Seiko Epson Corporation



Lightfastness Testing Chamber, Seiko Epson Corporation

■ Gaseous Pollutants

Gaseous pollutants can adversely affect inkjet prints. Printer manufacturers have made important advancements in ozone resistance for both pigment and dye-based inks. But dye-based inks printed on porous papers can still be vulnerable to the effects of high levels of ozone in homes and offices or when they are close to ozone producing devices such as copier machines, computer monitors and air filtration systems. For shorter term display, most dye-based inks are sufficiently resistant to ozone. For longer term display, framing prints behind glass or storing them in albums can prevent ozone damage. Inkjet prints made with pigment-based inks are less susceptible to ozone damage and will have greater permanence characteristics than prints made with dye-based inks in the same conditions. Traditional silver-halide color prints are not specifically affected by ozone, but may be vulnerable to other atmospheric contaminants such as smoke. Traditional silver-halide prints will, for the most part, fade due to light before an inkjet print made with pigment-based ink is affected by ozone.



Environmental Testing Chambers, Seiko Epson Corporation

■ Temperature and Humidity

High temperatures and high humidity levels adversely affect all color print materials and cause the colors in traditional silver-halide photographic images to deteriorate more rapidly. The behavior of inkjet materials can vary widely, again depending upon the different types of papers used and if the inks are dye or pigment-based. In humid conditions, inkjet prints made with dyes, particularly those that have been printed on swellable papers, tend to lose sharpness and suffer from changes in color balance and density due to dye migration. Inkjet prints made with pigment-based inks are usually much less sensitive to high temperature and high humidity than traditional silver-halide prints and dye-based inkjet prints. Prolonged storage in high humidity can produce fungal growth on all prints, including silver-halide.



Environmental Testing Chamber, Seiko Epson Corporation

What We All Need to Do

To make an informed decision on papers and inks, consumers and professional photographers alike must take into account all permanence-related factors as well as the image quality characteristics of any product. There simply is no magic paper that will work with all types of inkjet systems without some kind of significant compromise.

Comparative and rigorous print permanence tests are important for both the amateur and the professional for all types of photographic prints whether they are silver-halide, dye-sub or inkjet. To preserve precious memories, the amateur photographer must make correct choices of materials based on unbiased print permanence research. And professional photographers need to recognize that their products will often be displayed by the buyer in lighting conditions containing ultraviolet radiation with lux levels that are significantly higher than 120. If these prints fade prematurely, the professional's reputation and livelihood is at risk.

Compatibility Claims Can Lead to Unfortunate Compromises

An inkjet print is the product of a closely interrelated system of printer, ink and paper working together. Epson does extensive research during all stages of product development to optimize this system to ensure high levels of both image quality and print permanence. Products from third parties labeled as “compatible with” or “suitable for” are often one-size-fits-all claims that rely only on the lowest common denominator. While there may be certain combinations of third party ink and paper that yield acceptable results on certain printers, there are numerous examples of prints made with combinations of ink and media that will produce poor image quality and/or lead to print fading in only a few years.

Unfortunately guarantees of longevity typically only involve the replacement of paper. So if a print with a 100-year claim fades in real life conditions in less than 20 years, the owner of the faded print may only receive replacement paper as compensation. But at that time, it may be difficult or impossible to locate a usable digital file to reprint the image, and just like what happened in the 1980s with prints made in the 1960s, an important memory could be lost forever.

■ Water

The chance of water damage increases as prints are displayed or stored for extended periods of time. Likely sources are spills; overspray from cleaning; sneezing; wet or sweaty hands; floods; or leaky pipes and roofs. Dye-based inkjet prints, especially those printed on swellable papers, are susceptible to water damage any time a print is touched with wet hands or otherwise comes in contact with water. Pigment-based inkjet prints are relatively water resistant unless inappropriately used in conjunction with a swellable polymer paper, such as Kodak Ultima.

Should Every Print Last Forever?

A recent study showed that 72% of consumers think a photograph should last forever. But photography is not only about memories or fine art exhibition. There are applications and situations where surface texture, speed, productivity, size, etc. may be more important. Therefore Epson makes a variety of printers, inks, and papers and has the know-how to combine them to deliver suitable combinations of longevity and quality for different applications.

Often one does not know the importance of an image until many years have gone by. And often our most treasured images are displayed for long times in a wide variety of environmental conditions that may prove to be detrimental to prints. When Epson pigment inks are used as directed with a wide variety of Epson media, these prints will have better print permanence than any Eastman Kodak silver-halide or dye-sub color print. Conservators have recommended that even for short-term display, or when the desire to save a print is uncertain, it is always best to frame all types of images behind glass. Framing behind glass provides protection against accidental spills, fingerprints and exposure to a wide variety of airborne pollutants such as cigarette smoke and cooking vapors.

Industry Accepted Practices & Comparative Tests

Most manufacturers of traditional and digital photographic materials follow industry accepted test practices. While any predictive test cannot be seen as a guarantee, comparative testing by an independent third party laboratory such as Wilhelm Imaging Research, Inc. using accepted industry practices allows consumers and professionals to make informed decisions based on how different products perform relative to each other under the same conditions.

Most people probably would not find it acceptable for each automobile company to test fuel efficiencies of their cars by their own criteria rather than by government mandated miles-per-gallon standards. Likewise, consumers and professionals alike should be wary of any company making claims of image quality and/or print permanence based on test methodologies that fall far short of the criteria used by the rest of the industry. Consumers and professionals also should be cautious about data published or referenced from a third party using a manufacturer's proprietary practices. Third parties can be commissioned by a manufacturer to verify results with the manufacturer's own set of non-industry accepted practices. When this happens the third party is not making any endorsement of or recommendation for the product that was tested, but is merely providing verification of data gathered under that manufacturer's particular set of conditions. Consumers must have apple-to-apple comparative data to make informed choices.

Why You Should Care

If consumers and professional photographers do not insist on unbiased comparative data obtained with rigorous test procedures and confirmed by reputable independent test laboratories, we see three profound negative outcomes:

- The public will not be able to get accurate and meaningful information to make informed purchase decisions about which products can be counted on to produce photos they will cherish and pass on to their children.
- Companies may have to shift research and development funding for continual print permanence improvements over to marketing efforts in order to compete against those who choose to lower the playing field.
- The credibility and reputation of photography itself will be at risk as:
 - A reliable method to preserve memories
 - A credible way to document the times in which we live
 - A viable and valuable fine art in itself

Conclusion

We at Epson believe consumers should have access to unbiased comparative print permanence data based on uniform rigorous test criteria so they can make informed choices about the photographic materials on which they print their precious memories. The long-term survival of photographs and our photographic heritage must not be shortchanged by overstating the permanence characteristics of any paper, ink, other imaging material, or their combinations.

Photographs are simply too important to our civilization to be subjected to undisclosed compromises about their longevity.

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