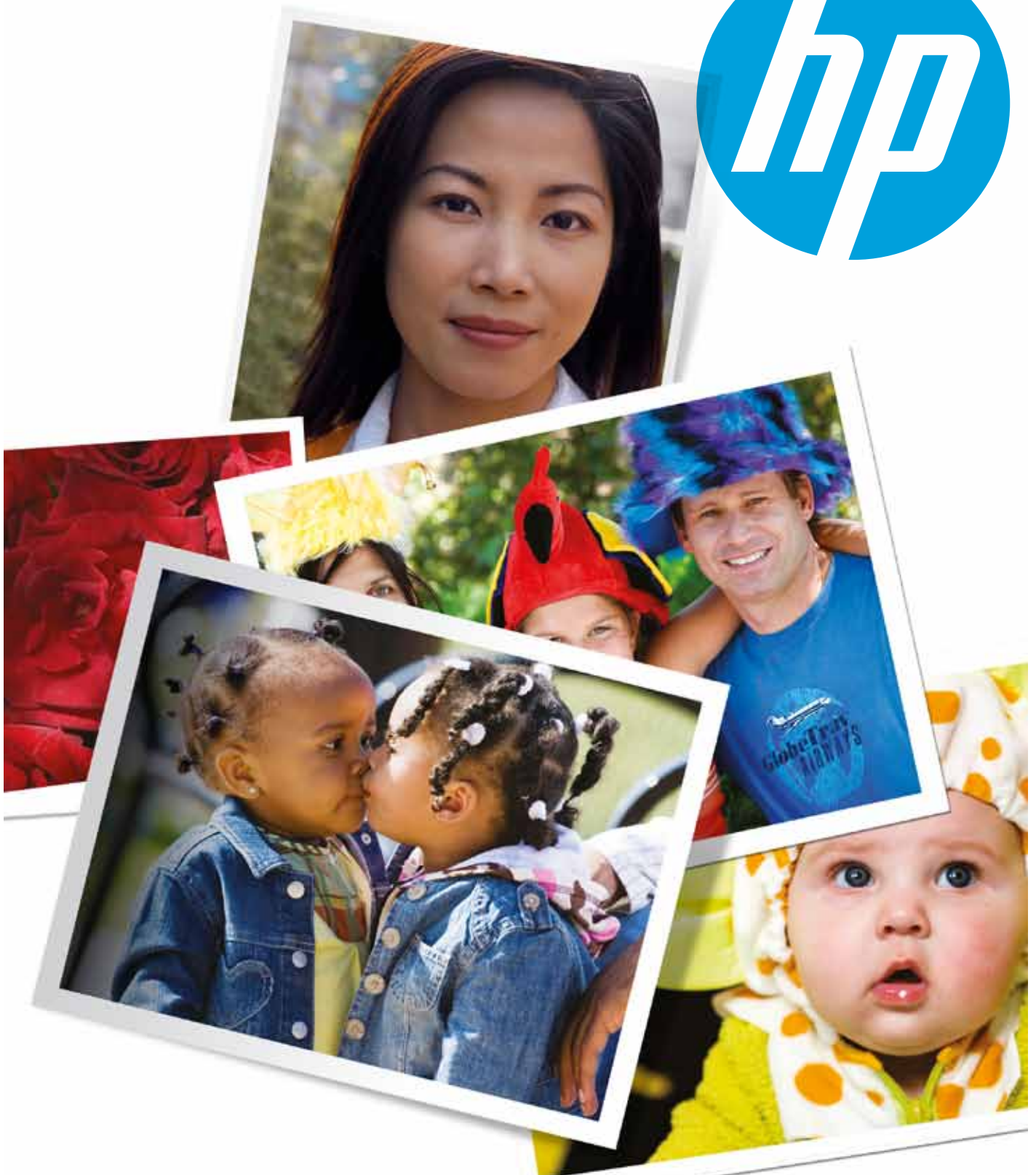


# HP Indigo Print Permanence

Sustainable photo memories





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## Why print memories

In the digital age, visual images are captured and shared constantly through electronic means. To make digital photo memories last for generations photos must be printed. A large majority of photobooks worldwide are printed today on HP Indigo's high-quality presses.

HP Indigo understands the importance of keeping cherished memories alive. To confirm the permanence of HP Indigo's photo prints, the photo products were submitted to an independent research laboratory, Wilhelm Imaging Research (WIR), for testing at HP Indigo's expense. The results verified the permanence of the HP Indigo photo solution, validating that HP Indigo photobook pages will last for at least 200 years, while photos printed on HP Indigo presses for display outperform the most widely used silver halide papers.

HP Indigo is the only digital press manufacturer that has published print permanence results from independent testing. This paper will present these test findings, enabling the print service provider to provide both consumers and professionals answers to these questions: How long do HP Indigo digital photo prints and photobooks last? How should they be protected to withstand the test of time?

## Importance of photo permanence

Print permanence determines how well photos and their colour are preserved and withstand the rigors of their environment. Over time, the optical density, colour balance, luster, and other qualities of photos gradually degrade. The photo print's rate of deterioration depends on the colourants used to form the image, paper quality, and type of exposure to the environment.

While customers are faced with a multitude of product choices and printing technologies, they are rarely or never presented with print permanence information to assist in their printing choices. In fact, there is a broad range of permanence performance among digital printing technologies. To enable consumers and professionals to make informed choices, they should be made aware of the permanence quality of products they are choosing.



## Image permanence testing by Wilhelm Imaging Research

The WIR laboratory conducts research on the stability and preservation of traditional and digital colour photographs and motion pictures. In the absence of international standards on print permanence, this independent image testing company has become a leading authority on photo permanence. The company publishes brand name-specific permanence data for desktop and large-format inkjet printers and other digital printing devices.

While the International Organization for Standardization (ISO) has developed standards for the testing of image permanence, these standards have yet to be extended to digital print output, though the organisation has signaled its intent to provide such standards. The WIR results are published ([www.wilhelm-research.com](http://www.wilhelm-research.com)) to help make it possible to select the best products when image permanence is an important consideration.



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## HP Indigo printing technology

The photo-quality prints produced by HP Indigo presses are created using unique printing technology: liquid electrophotography (LEP). This printing process, developed by HP Indigo, uses HP Indigo ElectroInk containing electrically charged, minute ink particles dispersed in liquid, allowing for higher resolution, uniform gloss, and sharp image edges. The very thin ink layer is almost transparent, exposing the natural attributes of the paper for a fine photo finish.

The HP Indigo printing method enables high quality, a wide and accurate colour gamut, and sharp images, all of which exceed the quality achieved by competing digital printing technologies. The HP Indigo photo printing solution using CMYK delivers high-definition photos. For high-end professional photo quality, the solution also offers additional inks—light cyan and light magenta—for realistic skin and sky tones, and light black for superior grayscale images. The unique attributes of the HP Indigo printing technology have made it the premier digital photo printing solution worldwide.

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## WIR testing of HP Indigo digital photos

A WIR study was recently conducted\* on the image permanence of prints and photobook pages produced on HP Indigo presses using the HP Indigo's ElectroInk unique liquid pigment ink. Accelerated light exposure and dark aging tests determine the comparative life expectancy of digitally printed photographs.

The tests were conducted on prints produced on the HP Indigo press 5500, but WIR's results are applicable to the full range of HP Indigo digital presses. \*\* Testing was conducted on HP Indigo photo prints on four different paper/HP Indigo ElectroInk combinations, including on paper especially designed to give the look and feel of photo prints.

Kromekote Digital Printing Paper	4 inks	CMYK
Kromekote Digital Printing Paper	6 inks	CMYK + light cyan and light magenta
Felix Schoeller E-Photo LUSTRE photo paper	6 inks	CMYK + light cyan and light magenta
Felix Schoeller E-Photo LUSTRE photo paper with lamination	6 inks	CMYK + light cyan and light magenta

## WIR testing methodology

Discolouration or fading of photos is caused by many environmental factors. The WIR laboratory conducts separate tests for each factor that can cause deterioration of photo quality: **light fading, heat and humidity fading, and gas fading**. It employs accelerated tests that emulate natural conditions, exposing the material to the environmental factor in a concentrated manner. The tests determine the degree of image bleed and changes in density and colour balance and give ratings according to when the discolouration is first noticeable. Each type of printed material (ink/paper combination) has its own image stability characteristics, with some far more stable than others according to the WIR report.

\*Published on March 7, 2011. For the full report see [www.wilhelm-research.com/HPIndigo/HPIndigoDigitalPresses](http://www.wilhelm-research.com/HPIndigo/HPIndigoDigitalPresses)

\*\*HP Indigo 7600 Digital Press, HP Indigo 7500 Digital Press, HP Indigo 7000 Digital Press, HP Indigo W7250 Digital Press, HP Indigo W7200 Digital Press, HP Indigo WS6000p Digital Press, HP Indigo 5600 Digital Press, HP Indigo 5500 Digital Press, HP Indigo press 5000, HP Indigo 3500 Digital Press.



### Light fading

The lightfastness of prints and photobook pages is tested to determine years of display under exposure to UV light before noticeable fading occurs. WIR performs accelerated light stability tests by exposing prints to light at levels 35 to 200 times brighter than normal conditions. Predictions are based on display conditions that expose prints to 450 lux, 12 hours per day. Accelerated light stability tests are conducted at 35 klux at a constant temperature of 23°C with 60% relative humidity (RH) under glass-filtered, cool white fluorescent illumination. To ensure the purity of light stability data, the testing removes other factors that would compromise the results, including humidity and pollutants.

### Heat and humidity fading

Deterioration of photos is also affected by temperature and relative humidity, especially in dark storage. High temperatures and/or high humidity exacerbate the problems. WIR conducts tests at high temperatures (eg. 57 °C, 64°C, 71°C, and 78 °C) at a constant relative humidity of 50% RH. In relative high humidity over the time, prints may suffer from colour balance changes, density changes, lateral ink bleeding, bronzing in high density areas, sticking, and ink transfer. The WIR humidity fastness test is performed at high relative heat and humidity of 30°C and 80% RH.

### Gas fading

Fading of photos exposed to the open atmosphere is also caused by gases. Papers displayed unframed are vulnerable to the open atmosphere even where very low levels of air pollutants are present. To assess gas fading of indoor unframed prints, WIR conducts accelerated exposure tests for "Unprotected Resistance to Ozone" using a test chamber maintained at 23°C and 50% RH.

Multiple tests are executed to simulate conditions where photos and photobooks are stored. Photo consumers and professionals either display their photos or put them away in albums. WIR gives separate ratings for each of these categories.



Original

Simulated impact of environmental factors on photos over time.



20 years



40 years



60 years



80 years


# Album and dark storage permanence

Preservation of photographic memories has changed dramatically in the past 10 years, as more and more photos are being printed in photobook form, partly protected from the open light and atmosphere. Dark permanence measures the longevity of photos stored in albums and photobooks, when most of the time the pages are not exposed to light.

Like displayed photos, photos in dark storage may also “suffer yellowing of the print paper, image fading, changes in colour balance, and physical embrittlement, such as cracking and/or delamination of the image layer,” according to WIR. To ascertain dark storage and album permanence, the company conducts stability tests on photos exposed to elevated temperatures and separately to high humidity.

## HP Indigo WIR album and dark storage ratings

WIR's Album Permanence Ratings validate the archivability of HP Indigo photobooks. All four of the Indigo printing combinations that underwent album/dark permanence testing earned the maximum WIR dark permanence ratings of > 200 years.\* In comparison, WIR gives silver halide photos a much lower album/dark storage rating of > 100 years.

	Print	Album/dark permanence rating
	HP Indigo	> 200 years
	Fuji Crystal Archive	> 100 years
	Kodak Edge Generations	> 100 years
	Konica Minolta Impresa	> 100 years

\*WIR dark storage stability test results for photobooks are valid only for pages printed inside or on the cover of the book and do not cover other materials used to produce the book.

\*\*Tests are based on ISO standard 18935: 2005).

## Durability testing

Durability refers to how well an image resists accidents such as spilled water, smudging, and fingernail scratches. In the study on photo printing on HP Indigo presses, WIR testing was conducted for waterfastness. Both water drop tests and standing water droplets/gentle wipe tests are employed.\*\* WIR categorises the water resistance results according to three levels: “High,” “Moderate”, and “Low.” In the two tests on HP Indigo printing on photo papers produced by Felix Schoeller, WIR gave both the HP Indigo prints a rating of “high” resistance to water. One test was of Indigo 6-ink printing on Felix Schoeller E-photo paper and the other on the same paper with lamination. The result was comparable to the high resistance rating for Fuji Crystal Archive paper. The other two tests of HP Indigo printing with 4 inks and 6 inks on Kromokote Digital Printing Paper resulted in “moderate” water resistance.





# Display permanence

Display permanence refers to how long a photo can be on display before noticeable signs of fading, changes in colour balance and/or staining occur. Photo prints are displayed under varying degrees of protection – from totally bare and uncovered, to framed under glass, or UV filtered glass or plastic. Photos can be harmed on display by intense light, high temperature and humidity, and exposure to gases, with the rate of fading affected by the level of protection from these elements.

Lightfastness permanence tests simulate all types of display: bare and unframed; framed under glass; and framed with UV filter.


The major cause of fading with most digital and traditional colour prints in indoor display is visible light\*, and “although a UV filter may slow fading, it will not stop it,” according to WIR. Illumination conditions in homes, museums, and galleries vary, and colour images will last longer when displayed under lower light levels.

Since ordinary glass absorbs most UV radiation while maintaining colour balance, and also protects photos from airborne contaminants and staining, WIR considers the “Displayed Prints Framed Under Glass” test in typical indoor situations the superior of the three display conditions.



## HP Indigo WIR display permanence ratings

The display permanence ratings for HP Indigo photo prints far exceed the results of tests conducted on photos printed on industry standard silver halide papers, as indicated in the following table.

	Printer/ink/paper	Display permanence rating framed under glass	Display permanence rating framed with UV filter	Display permanence rating unframed–bare bulb
	HP Indigo on Kromkote Digital Printing Paper	38 years	54 years	23 years
	HP Indigo on Felix Schoeller E-Photo Paper	31 years	36 years	21 years
	Kodak Edge Generations (silver halide colour print)	19 years	18 years	18 years
	Konica Minolta Impresa (silver halide colour print)	17 years	19 years	16 years

## Summary of HP Indigo print permanence

The permanence ratings from WIR—the industry's most respected authority on digital print permanence—provide an important validation for the use of HP Indigo digital presses in consumer and professional photo merchandise markets as well as in the fine art world. The HP Indigo photobook page permanence rating of more than 200 years ensures excellent long-term stability and freedom from gradual yellowing when stored in albums and other dark locations. This is essential for securing creative and family memories. The silver halide replacement quality of Indigo prints is demonstrated in both display and dark storage conditions. HP Indigo is proud to have put its prints to WIR testing. HP Indigo is the only digital press manufacturer that has published print permanence results from an independent research lab. The test results and storage recommendations should be used to inform customers of the viability of HP Indigo prints over time.



Print	Album/dark permanence rating
HP Indigo	> 200 years
Fuji Crystal Archive	> 100 years
Kodak Edge Generations	> 100 years
Konica Minolta Imprensa	> 100 years



Printer/ink/paper	Display permanence rating framed under glass	Display permanence rating framed with UV filter	Display permanence rating unframed—bare bulb
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**North America**  
 Hewlett-Packard Company  
 5555 Windward Pkwy  
 Alpharetta, GA 30004  
 USA  
 Tel: +1 800 289 5986

**Europe, Middle East, and Africa**  
 Hewlett-Packard Española S.L  
 Cami de Can Graells, 1 – 21  
 08174 Sant Cugat del Valles  
 Barcelona  
 Spain  
 Tel: +34 902 027 020  
 Fax: +34 935 82 1 400

**Asia Pacific**  
 Hewlett-Packard Company  
 138 Depot Road  
 Singapore 109683  
 Tel: +65 6727 0777  
 Fax: +65 6276 3160

**Latin America**  
 Hewlett-Packard Company  
 5200 Blue Lagoon Drive  
 Suite 950  
 Miami, FL 33126  
 USA  
 Tel: +305 267 4220  
 Fax: +305 265 5550  
 informahpindigo@hp.com

**Israel**  
 Hewlett-Packard Company  
 Kiryat Weizmann  
 P.O. Box 150  
 Rehovot 76101  
 Israel  
 Tel: +972 8 938 1818  
 Fax: +972 8 938 1338

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