

The Importance of Quality in Photo Gift Production

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Abstract

Photo gifts include a far greater variety of materials than used in traditional photo finishing operations. Durability and image permanence play important roles in the quality of these products, which include photo books, poster, mugs, mouse pads, and other items. In some cases, traditional test methods may be modified to assess the quality of these products. In other cases, entirely new test methods are required. This presentation will compare the performance of photo gifts to traditional photographic materials under a variety of test conditions.

Introduction

Testing ensures that high-quality products are produced in the digital fulfillment process [1]. The definition of high quality is not always clear. However, to many customers it is related to their experience with traditional photography. Their expectation is that digital prints will have the same quality as silver halide prints. In many cases, this expectation holds even if the product is completely different from a 4x6 print, for example a mug or photo book.

The media, colorants, and processing for photo gifts differ significantly from traditional photography. In addition, photo gifts are, by definition, not designed to go in an album but are instead intended to be displayed, used, and otherwise abused. These differences make it difficult to match the look and feel of the traditional print when producing photo gifts.

Longevity may also be important. The lifetime of photo gifts must be comparable to or better than traditional photographic products for applications requiring display or long-term preservation.

An additional complicating factor is that many of the test methods for digital prints have not been standardized but instead must be developed for testing a specific product. In some cases, test methods exist for traditional photographic products and may be modified to evaluate photo gifts.

Thermal Transfer

Many photo gifts are produced with thermal transfer processes, rather than through direct printing. In this process, inkjet is used to produce a donor, and the colorants are subsequently transferred to the photo gift. Thermal transfer has many benefits, including the availability of a wide array of receptors. These gifts generally have good light stability and excellent abrasion and water resistance.

The Photo Panel is a glossy pressed wood panel produced with thermal transfer. It is representative of other products produced via this process, including mugs, ornaments, puzzles, etc.

Determining light stability is problematic because there is no standard test method so the best we can typically do is give customers an idea of how their products perform relative to typical photographic products. Actual lifetimes are dependent on the illumination levels and may vary significantly from predictions based on accelerated tests.

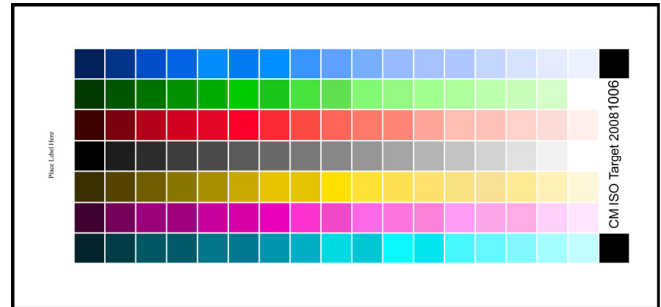


Figure 1. Light stability test target.

Light stability was measured at 0.5, 1.0, and 1.5 densities for red, green, blue, yellow, magenta, cyan, and neutral patches, with failure defined as a 40% density loss or 20% color balance change. Single point measurements were used if the measured density values were within 10% of the target values; otherwise interpolations were used. Illumination was with a xenon arc light at 88 klux with an L37 UV filter. Ozone was reduced to less than 2 ppb. Lifetimes were calculated using 250 lux illumination for 12 hours per day.

In this test, the light stability of the Photo Panel was comparable to conventional photographic prints, Table 1.

Table 1. Light stability of Photo Panels produced through an inkjet thermal transfer process.

Sample Description	Hours	Display Lifetime (Years)	Failure
Photo Panel	141	11	0.5 blue color balance
Kodak Royal	194	16	0.5 yellow
Fuji Crystal Archive	208	17	0.5 red color balance

Abrasion resistance, water resistance, and spill resistance of the Photo Panel is excellent. Coffee, cola, and peanut butter, which represent typical consumer spills, were easily wiped off and left no residue. Water resistance was evaluated according to ISO 18935. Water did not affect the Photo Panel when it was immersed.

The greatest concern with thermal transfer is image quality, particular when customers add text to photographs. 100-150 dpi may be sufficient to satisfactorily reproduce many consumer photographs; however, it is clearly insufficient to reproduce text, Figure 2. The loss in sharpness is clear.

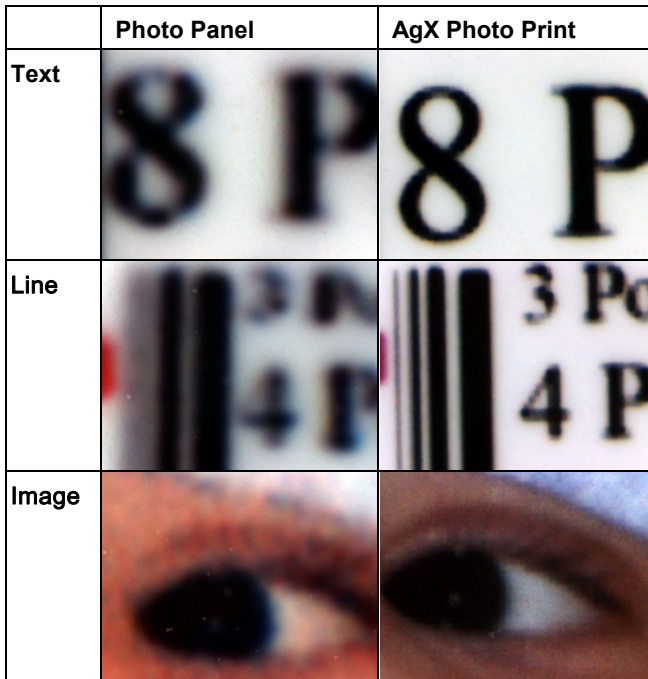


Figure 2. Image quality of thermal transfer and traditional photographic printing (10X magnification).

Electrophotography

Photo gifts not produced by thermal transfer are frequently printed using high-speed electrophotographic printers. These gifts include photo books, calendars, and cards. With electrophotography, light stability is frequently better than traditional photographic processes. In accelerated testing designed to simulate approximately 35 years indoor display, Nexpress electrophotographic prints did not reach any failure points, while corresponding photographic prints reached failure points at 16-17 years.

Resolution of electrophotographic prints may be high as or higher than traditional photographic prints, Figure 3. Photographic printing is truly continuous tone, which makes it difficult to separate resolution from other factors when comparing the two technologies.

Traditional photographic prints are the standard for image quality, and many electrophotographic prints may appear to be “non-photographic.” Customers may not even know why they object to these prints, but the “non-photographic” appearance generally relates to the surface gloss and texture. To meet customer expectations for photographic image quality, the gloss and gloss uniformity of electrophotographic prints must be comparable to traditional photographic prints.

Digital presses can match the gloss performance of traditional photographic prints, Table 2. In this comparison, the first electrophotographic print had similar gloss with less gloss differential than a traditional photographic print.

Traditional photographic prints are also available with a matte surface. Through careful choice of materials, a matte surface is also possible with electrophotographic prints. The matte surface generally requires an additional surface treatment.

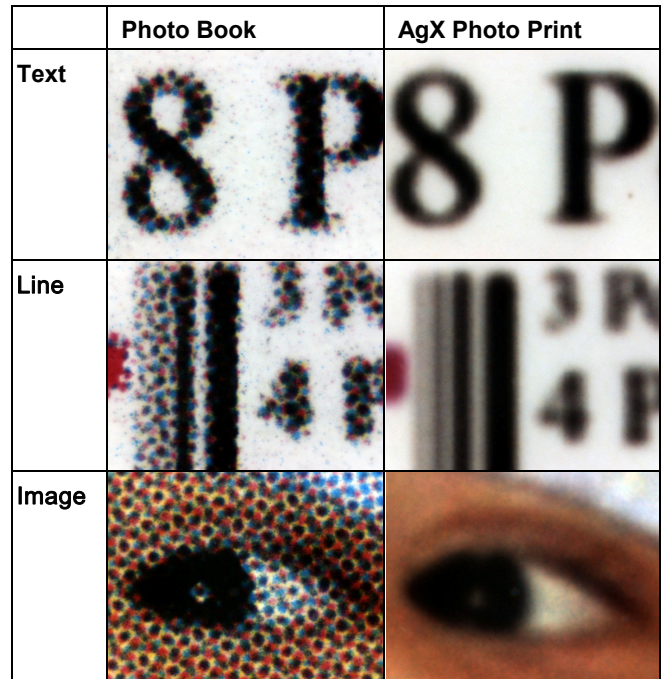


Figure 3. Image quality of electrophotographic and traditional photographic printing (10X magnification). These prints include the effect of file size reduction to facilitate photo book transmission.

Table 2. Gloss of electrophotographic and traditional photographic prints following the procedure given in ISO 19799 for 20° gloss measurements.

Sample	G_{mean}	$Dg (G_{\text{max}} - G_{\text{min}})$
Kodak Nexpress with Glosser	87.3	7.5
Xerox iGen4 with UV coating	31.2	14.8
Fuji Crystal Archive (Glossy)	88.2	8.2
Kodak Royal (Glossy)	77.8	9.8

Gloss measurements show that it is possible to come reasonably close to the gloss of traditional matte photographic print with electrophotography, Table 3. Gloss differential, however, remains significantly greater.

Table 3. Gloss for electrophotographic and traditional photographic prints following the procedure given in ISO 19799 for 60° gloss measurements. Sg corresponds to the visual assessment of gloss differential and ranges from 0 to 100.

Sample	G_{mean}	Dg	Sg
Kodak Nexpress with Dimensional Toner	30.1	18.4	12.6
Xerox iGen4 with UV coating	11.1	4.1	10.1
Fuji Crystal Archive (Matte)	41.0	2.2	2.5
Kodak Royal (Matte)	36.8	2.4	3.1

Conclusions

Traditional photographic prints remain the standard for photographic image quality, even when producing photo gifts that may have entirely different applications. Some photo gifts can match the image quality of traditional photographic prints through careful selection of materials and production processes. Other photo gifts may have specific limitations. The key is to understand the relevant characteristics of traditional photographic materials and then to carefully evaluate the same characteristics for photo gifts.

Acknowledgements

The author would like to thank Bonnita Bernhardt and Shanna Bach for conducting many of the tests described in this paper.

References

- [1] M. B. Mizen, "The Role of Product Testing in Digital Fulfillment," IS&T, International Symposium on Technologies for Digital Fulfillment, Las Vegas, NV, March 5, 2007.

Author Biography

Dr. Mark Mizen is currently Director of Technology for Creative Memories, a direct sales company with sales force of over 60,000 independent Consultants and annual sales exceeding \$200 million. He established and currently heads the in-house Technology Center, which rigorously tests and evaluates Creative Memories products. He led the effort to coordinate ISO photo-safety standards with Creative Memories product labeling and has developed specifications to ensure the longevity of photo books, digital printing, CDs and DVDs, and inkjet paper for scrapbooks. His monthly column in Scraps magazine and presentations at national meetings link the emotional aspects of memory preservation with photo-safety and performance of Creative Memories products.