New and Coming ISO Image Permanence and Durability Standards and How They Promote the Photo Fulfillment Industry

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Abstract

Recently published ISO permanence and durability standards, along with soon-to-publish standards in progress, will provide standardized testing and reporting of image permanence and durability performance. By using standardized methods for testing and reporting, companies can assess and promote product performance in a way that is easily comparable by both professional fulfillment laboratories and consumers. In addition, a new ISO joint working group has been formed that will mirror the ongoing convergence of printing technologies covering both the traditional photographic and graphic arts based printing. This paper will provide an overview of the new standards, the new joint working group, and the benefits these will provide in promotion of hard copy printing throughout the photo fulfillment industry.

Introduction

As noted in the goals of the International Organization for Standardization (ISO), the purpose of standardization is to help make industry more efficient and effective, with standards used as strategic tools for business to level the playing field and facilitate free and fair global trade. In the context of ISO Technical Committee 42 (TC42) on Photography, Working Group 5 is involved in the development of standards relating to the physical properties and image permanence of photographic materials. These standards are aimed at providing test methods for the measurements of stability of the photographic as well as the physical durability of the substrates and materials used to produce the image. With the growth of digital imaging and new digital print materials in addition to traditional silver halide materials, new tests methods were developed to cover the new print technologies of ink jet, thermal dye transfer, and electrophotographic media. Further, these new technologies, especially electrophotographic, have resulted in the convergence of the production of images from the traditional photographic sources with those using graphic arts technologies. A detailed discussion of standards published in 2011 and 2012 was reported in a previous paper [1]. This paper will provide a brief discussion of standards published in 2013 and those nearing publication, as well as the benefits to the industry of all the recently published standards on image permanence and durability.

2011-2012 Published Standards

ISO 18930:2011 – Imaging materials — Pictorial colour reflection prints — Methods for evaluating image stability under outdoor conditions

Published in September 2011, this standard provides standardized test procedures to evaluate image stability both in real-time outdoor weathering tests and in accelerated laboratory simulations of the weathering process.

ISO 18936:2012 – Imaging materials -- Processed colour photographs -- Methods for measuring thermal stability

Published in April of 2012, this standard provides the methods and procedures for measuring the long-term dark storage, i.e., thermal stability, of color photographs. In the long term, the vast majority of photographic images ultimately end up stored in the dark so the importance of this standard cannot be understated. The standard looks at the two common paths of thermal degradation of an image, colorant loss and D-min increase.

ISO 18937 – Imaging materials — Photographic reflection prints — Methods for measuring indoor light stability

This standard will publish shortly and describes test equipment and procedures for measuring the light stability of images of color photographic reflection prints designed for display when subjected to certain illuminants at specified temperatures and relative humidities. Of special importance to the photo fulfillment industry is the use of xenon light source for testing, which is a much more realistic simulation of the lighting in consumer homes.

ISO 18941:2011 – Imaging materials — Colour reflection prints — Test method for ozone gas fading stability

Published in November 2011, the ozone standard covers the equipment, methods and procedures for generating a known ozone exposure, and the subsequent measurement and quantification of the amount of change produced within a photographic image due to that exposure. The standard covers both hard copy materials for digital printing and traditional analog photographic color print images. With newer technology digital output materials often being more sensitive to atmospheric pollutants than traditional silver halide based technologies, this standard provides the means to test for this environmental factor that here-to-fore was not a major concern.

ISO 18944:2012 – Imaging materials — Reflection colour photographic prints — Test print construction and measurement

Published in April of 2012, this standard specifies requirements and recommendations for the digital test file content, number of print replicates, printer setups and printing procedures that are used to generate target prints for test method standards and specifications for image stability in the context of reflection color photographic prints. This standard is currently being revised.

ISO 18946:2011 – Imaging materials —Reflection colour photographic prints — Method for testing humidity fastness

Published in December of 2011, the humidity standard covers the methods and procedures for testing the humidity fastness of reflection color photographic prints. Low and high humidity exposures are covered and this test method is of particular relevance to dye-based ink-jet prints or dye diffusion process prints. The observed changes relate to color, tone, and loss of sharpness caused by horizontal and vertical diffusion of colorants from exposure to elevated humidity levels.

ISO 18947:2013 – Imaging materials — Photographic reflection prints — Determination of abrasion resistance of photographic images

The abrasion standard specifies tests to determine the abrasion, scuff, and smudge resistance of photographic images and is applicable to digital and analog prints including photo books. This method is one of a series relating to image durability. In contrast to image permanence standards that cover ever-present environmental factors such as light, heat, ozone and humidity, the durability standards cover factors that are not necessarily present in the environment. Although consumers may have less control over the environmental factors in which a print is stored or displayed, they may have more control over durability aspects such as careful handling and good quality storage enclosures.

Future Standards

18940 – Imaging materials – Reflection colour photographic images – Indoor stability specifications for consumers

The goal of this standard is to provide specifications for making consumer indoor life-expectancy estimates for digitally-printed hardcopy images and traditional analog photographic color print images using test data from the four method standards discussed above. The goal of this standard is a very difficult one. The results obtained with any single test method may be useful for comparing the related image stability of different products and systems, but may not match the actual behavior in the long term, real world conditions. The complications increase further when the standard attempts to define specific ambient conditions for light, heat, ozone and humidity in a "typical" consumer home.

18948 – Imaging Materials – Photo Books – Test Methods for Permanence and Durability

The photo book standard will be a collection of test methods to be used to test the longevity of photo books. As the number of digital cameras has increased, photo books have replaced the traditional photo album and scrapbook for many consumers and there is an increasing interest in their inherent longevity and durability. Photo book longevity depends on the image stability of the printed pages and the cover, if it includes an image, and on the durability of the binding. Some books may have good image print stability but lack in binding durability.

A key requirement for the successful completion of this effort is to include actual product usage experience from the market to insure that the standard is relevant to the products being delivered by the digital photo industry.

Fair and Level Playing Field – Comparing the Digital Printing Technologies

Of critical importance to the promotion and growth of digital printing in the photo fulfillment industry is the ability to do fair, consistent "apples to apples" comparisons of products from various manufacturers. With the growth of new digital printing technologies, test methods designed for traditional silver halide materials were insufficient to provide a complete picture in the permanence of these technologies. These new technologies have different degradation pathways compared to silver halide. The traditional environmental hazards to silver halide materials were heat and light. It is critical to recognize there are now two additional hazards: humidity and atmospheric pollutants. ISO 18941 (ozone) and ISO 18946 (humidity) provide test methods to address these factors and must be used in conjunction with ISO 18936 (heat) and 18937 (light) to provide a full and complete assessment of image permanence, covering all four environmental factors.

Humidity and atmospheric pollutants provide good examples to illustrate the need for the "level playing field" in the promotion of digital printing technologies. An unfair promotion of a given technology can happen when environmental factors are either over-emphasized (strengths) or not considered (weakness). Certain ink jet technologies, especially systems using dye inks on swellable media can be very sensitive to humidity. Silver halide technology, because the dyes are embedded in gelatin, and thermal dye transfer technology, because the dyes are protected by a laminate overcoat, are not sensitive to humidity. By comparing the image permanence of dye-swellable inkjet systems for light and heat but not discussing their permanence to humidity can create an unfair advantage over the silver halide and thermal dye transfer materials which are very insensitive to humidity. Likewise, certain dye-based inkjet systems on porous media can be extremely sensitive to ozone in the air. For the same reasons as above, silver halide and thermal dye transfer are very insensitive to ozone and ignoring ozone in product comparisons is misleading. A final example is light stability. Pigmented inkjet systems typically have higher light stability compared to silver halide, thermal dye transfer, and electrophotographic technologies but can be mediocre or poor in ozone and humidity performance. A product comparison discussing only light stability could put the latter three technologies at a disadvantage, especially in consumer applications.

JWG14 – New Joint Working Group

Joint Working Group (JWG) 14 was formed at the TC42 Plenary meeting held June 2013 in Copenhagen. With the convergence of photographic printing between the traditional photo industry and the graphics arts industry it is important that both technical committees (TC 42 Photography and TC130 Graphic Arts) are well aligned. This is especially important when both committees are working on similar standards, as was the case with the 18947 abrasion standard. To avoid redundancy and to insure that conflicting standards do not emerge the new JWG 14 will work together on standards development where the photographic and graphic arts printing technologies overlap such as in photo books.

Method Standards to Benefit to the Industry

Proper use of the permanence and durability standards can result in the growth of printing. By assessing products in conjunction with the appropriate standards that reflect the actual applications and usage conditions of the product, the standards provide a large benefit in product promotion. Again, this is most easily illustrated through example. In commercial display applications where exposure to high intensity light is expected, such as outdoor signage, the use of the four environmental standards (ISO 18936/heat, ISO 18937/light, ISO 18941/ozone, and ISO 18946/humidity) would properly illustrate the higher light stability of pigmented inkjet technology. On the other hand, in consumer home applications, where images are kept for multiple generations in predominantly dark storage conditions, the use of the four standards would show the strength and robustness of silver halide and thermal dye transfer technologies with their high stability to heat, humidity, and atmospheric pollutants. Photo books, a growth category in the fulfillment industry, when tested according to the upcoming method standard ISO 18948 will provide the “level playing field” assessment that will help further grow the category by giving consumers useful product comparison information. These examples illustrate the value of using the standards to properly promote the strengths of the various technologies in the context of real world usage applications.

Prediction Standards

Unlike the method standards above, prediction standards quickly become problematic for various reasons. Making a prediction requires an “endpoint”, the point at which the life of the print is ended. This is highly variable depending on the subject and personal connections to the print. Studies have shown acceptable endpoints range as low as 15% fade and as high as 70% fade from the original print [2, 3, 4]. This alone can create a large variation in predicted life. The other variable is the assumption used on the ambient conditions including levels of light, pollutant, humidity, and heat (temperature). Studies from around the world [5] showed that reasonable assumptions can be made but also showed that there are wide levels of variability in conditions [6] from country to country, region to region, and from continent to continent. A prediction based on a single set of assumptions will be invalid if any of the conditions vary from the assumption. Because the conditions in consumer homes around the world can vary significantly, it becomes impossible to make predictions based on a single set of assumptions; if attempted, predictions can vary significantly. If a standard predicts a print life of 50 years but the consumer happens to be in an environment with significantly different conditions than the assumptions, the actual print life would be very different. The consumer would be very disappointed to achieve a life of only five years when they expected 50 based on a predictive product claim. Many in the industry feel that a bad standard, that is, one that over- or under-predicts, is worse than no standard at all.

Prediction Standards to Benefit the Industry

As a result of the above issues, the Working Group 5 committee has chosen a comparative approach for the life specification standard, 18940. The current effort is to change the goals of the standard to avoid predictions based on years and move towards comparative assessments. This would avoid the need for defining endpoints and ambient conditions and the resulting mis-predictions when consumer homes do not meet those specific conditions and endpoint assumptions. To do this, the standard is being written to use fixed test loads or dosage for each of the four environmental factors and report the degradation results from each of the test conditions. This will allow the industry to make standardized comparisons to show how well their products will stand up to environmental degradation. Continuing the “level playing field” requirements above, this standard allows for a fair comparison between products because all products receive the same fixed dosage during the test (i.e., a fixed amount of light exposure, ozone exposure, heat exposure, and humidity exposure). Once issued, this standard will allow for the fair and balanced promotion by the fulfillment industry to assess the longevity of the products.

Conclusions

This paper has provided a concise summary of recent image permanence and durability standards from ISO Technical Committee 42 Working Group 5 and discussed the concept and use of method standards to assess and promote photographic media. In addition, the issues associated with prediction standards and an approach being used by the committee to avoid these issues has been discussed. Finally, the paper has provided examples to illustrate the concept of the “level playing field” in product testing and assessment for image permanence and durability and how these international standards can be used to promote commerce and grow the photo fulfillment industry.

References

[1] Adelstein, P and LaBarca, J 2013 ISO Image Permanence Standards Update; *Proc IS&T Symposium on Technologies for Digital Photo Fulfillment*, January 2013

[2] Oldfield D and Segur R 2004 Assessment of Current Light-Fade Endpoint Metrics Used in the Determination of Print Life – Part I *Journal of Imaging Science and Technology,* Vol. 48-6 pp 495–501

[3] Oldfield R and Twist J 2004 Assessment of Current Light-Fade Endpoint Metrics Used in the Determination of Print Life – Part II *Proc. IS&T Archiving Conf.* pp 36–41
[4] Y. Shibahara, M. Machida, H. Ishibashi, H. Ishizuka, 2004 Endpoint Criteria for Print Life Estimation; *Proc. IS&T International Conference on Digital Printing Technologies NIP 20*
[5] Bugner, D., LaBarca, J., Phillips, J., and Kaltenbach, T. 2006 A Survey of Environmental Conditions Relative to the Storage and Display of Photographs in Consumer Homes; *Journal of Imaging Science and Technology* 50(4): 309–319, 2006
[6] Mason P 2008 Accuracy in Photo Print Life Prediction; *Proc. IS&T International Conference on Digital Printing Technologies NIP 24*, pp242-246

Author Biography

Joseph LaBarca is a 16-year member of the ISO Technical Committee on Photography and is directly involved in the ANSI/IT-9 and ISO Working Group 5 Committees on color print stability and physical properties. After retiring from Eastman Kodak Company with over 34 years of continuous service Joe formed JEL Imaging Services in 2010 and Pixel Preservation International in early 2011, to provide consulting services to the imaging industry on image preservation, ISO standards, and image quality. He graduated from Bucknell University in 1976 with a Bachelor's of Science Degree in Chemical Engineering and spent a large part of his career at Kodak in the research, development, and commercialization processes for Kodak Ektacolor papers and processing chemistry. This included extensive involvement in the image stability of color papers beginning in the early 1980s and continuing for the remainder of his career at Kodak. In 1997, Joe was appointed Senior Research Lab Manager, directing a laboratory with systems responsibility for professional color negative films and papers. In 2004 Joe assumed the role of Technical Director, Image Permanence with responsibilities that included silver halide, inkjet, thermal dye transfer, and electrophotographic imaging systems. Joe has been a member of IS&T for over 25 years and was awarded Senior Membership in 2012. He has also been a member of the American Institute for Conservation since 2008. In mid-2011 he was appointed to the position of Visiting Scholar in the College of Imaging Arts and Sciences at Rochester Institute of Technology.