Effective Use of Color Inkjet Print Technology For the Creation of GHS Labels

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Abstract

With GHS implementation of color pictograms as a primary means to communicate workplace hazards, color inkjet technology provides a cost – effective option in the search for an efficient and effective method of producing HCS 2012 compliant hazard communication labels.

The challenge facing any organization with respect to systems that utilize in-house printing technologies is ensuring that labels created using these methods meet all aspects of global regulations. Absent a single comprehensive set of test criteria, regulatory compliance professionals are challenged with reviewing a variety of standards in their efforts to ensure compliance with existing standards and regulations. The testing protocol outlined here follows this same approach. By referencing the applicable sections included in the BS5609 Maritime standard, 49 CFR, 29 CFR, EC 1272 and the ACA HMIS UV Resistance Standard the research endeavored to gain the conclusive proof necessary to confirm that color inkjet generated labels could meet all of these requirements.

The data indicates that the most critical steps in the process involved choosing the correct type of inkjet printing device and pairing it with a certified GHS compliant label face stock. With proper due diligence, regulatory compliance professionals can be confident their company's labels meet all existing and proposed standards for the labeling of chemical products when using color inkjet generated GHS labels.

Introduction

The new Globally Harmonized System for labeling of chemicals requires pictograms in addition to the hazard and precautionary statements in order to communicate workplace hazards effectively. The majority of these images include the addition of a color printed symbol. Regulatory Compliance professionals must incorporate these multi-color pictograms into their organizations label designs.

Many organizations world-wide opt for an in-house print on demand labeling platform to help improve hazard communication while increasing operational efficiency. Inkjet print technology provides a convenient methodology for adding workplace pictograms. With a variety of standards and regulations to be met, organizations must be certain labels produced using this technology are compliant. This report pulls together those standards and regulations and follows the prescribed testing protocol outlined where provided or develops test methods which demonstrate performance characteristics of color inkjet generated images.

The research here set out to establish whether these newer color inkjet printing devices would enable Regulatory Compliance professionals to include pictograms in their organizations label designs while at the same time ensuring their compatibility with all current global standards for labeling chemical materials.

Internal Testing Methods/Results

UV Resistance- ASTM G155-05a

Testing is performed utilizing an Atlas Model 65WR Fadeometer/Weatherometer unit with testing parameters based on ASTM Standard G155-05a titled "Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials." The testing apparatus employed utilizes a "long arc" water cooled 6500 watt Xenon-Arc lamp vertically located at the center axis of a 95.89 cm diameter inclined multi-tier specimen rack that rotates at 1 rpm. The Xenon-Arc lamp is enclosed within Borosilicate glass inner and outer optical filters to simulate the spectral power distribution of natural daylight. Spectra irradiance is .35 w/m2/nm at 340nm as read by the integrated light monitor and with continuous light utilized for the testing. This intensity is the approximate equivalent of the average for high noon in South Florida. Chamber air temperature is at 40 degree C, specimen (Black-Panel) surface at 60 degree C, relative humidity is typically 10 to 20%. Testing is typically performed for 1,000 hours; this exposure time is based on available industry data as the approximate equivalent of 1-year of South Florida sunlight exposure.

Results

There was no measurable change in the color or the density of the imaging after the completion of the 1,000 hour fadeometer test as compared to un-exposed samples. Anchorage of the imaging to the face stock was excellent with no adhesion failures.

Label Construction Imaging:

5 Mil White Poly-Twin EP™ Inkjet Imprinting: HP X4XXX; Epson 8XXX color printers, Neuralabel 300x

Toner anchorage – ASTM D5264-88

Testing was performed utilizing the Sutherland Rub Tester and following the ASTM D 5264-98 titled "Standard Practice for Abrasion Testing of Printed Materials by the Sutherland Rub Tester". The test was performed with a 4 lb weight, the specimen was the color inkjet imaged label and the receptor was another section of the same label. Values are assigned based upon when image offsetting occurred and/or major scuffing was noted.

Results

The Poly-Twin EP™ samples exceeded a 200+ value and the test was halted. >150 value is standard for flexographic printed substrates.

Label Construction Imaging:

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BS5609 90 Day Seawater Submersion:

The test was intended to simulate the actual conditions under which labels are expected to perform. Key observations during the testing included any label performance failures and color inkjet image degradation.

Label Construction Imaging:

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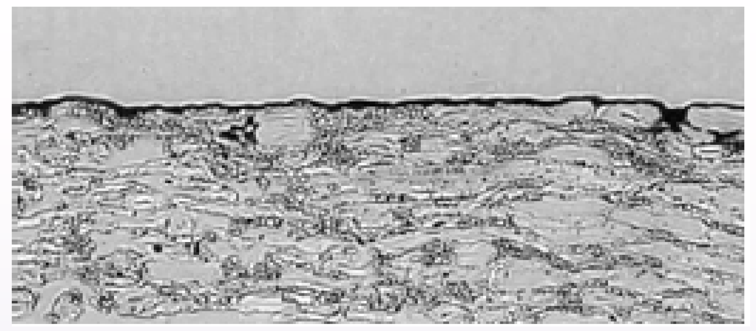


Drum Type:

Blue HDPE and Black painted steel.

Seawater Medium:

Coralife Scientific Grade Marine Salt Mixture dissolved in distilled & deionized water.

Specific Gravity: 1.021 – 1.023
PH: 8.2 – 8.3
Calcium: 390-410ppm
Magnesium: 1250-1300ppm
Sodium: 1100-11500ppm
Potassium: 380-390ppm

Test Protocol:

Test panels measuring 10 inches square were cut from the HDPE and Steel drums. Multiple samples of the label construction were hand applied at room temperature and rolled down with a 4.5lb. weighted steel roller covered with a Shore scale A durometer hardness rubber to the panels and dwelled 24hours prior to submersion. The seawater solution was prepared in a 5 gallon HDPE bucket for the test panels. Following submersion the buckets were sealed to prevent evaporation and stored at ambient temperature for the 90-day period. The buckets were opened briefly for periodic evaluations throughout the test cycle.

Time Frame:

Test Started: April 8, 2015 Test Completed: July 11, 2015

Results/Observations:

The label samples adhered well to the HDPE and steel drum panels with no edge lifting around the perimeter of the labels on both drum types. Removal of the labels from the HDPE panels was possible with a moderate percentage of the adhesive remaining on the HDPE surface. Removal of the labels from the steel panels caused the painted surface on the panel to fail with the majority of the paint staying with the label adhesive. The inkjet imaging was completely legible with no fading or degradation, adhesion of the toner to the label face-stock was excellent

External Certifications

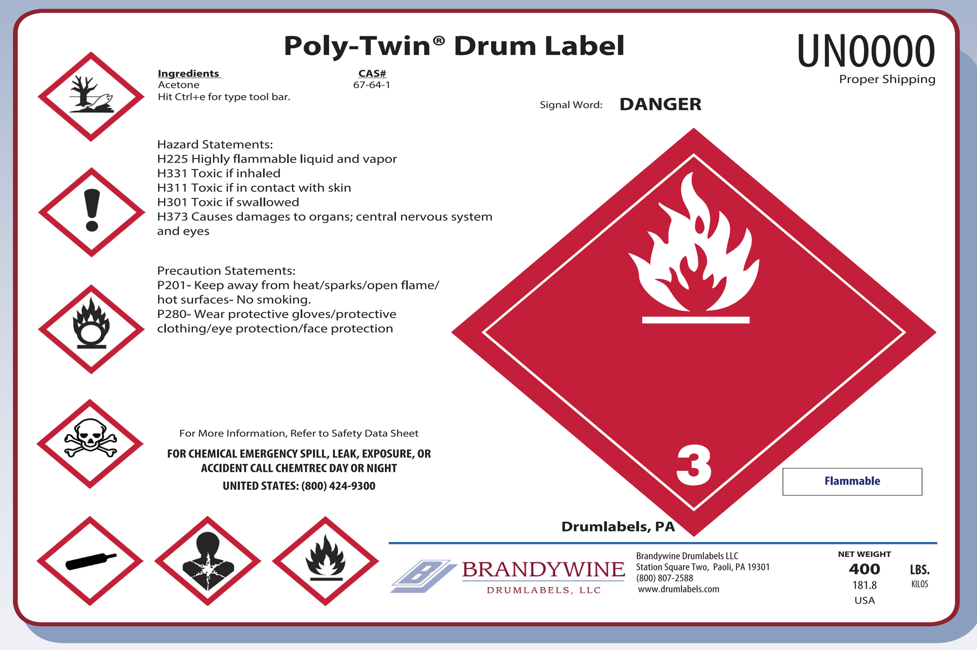
Smithers-PIRA BS5609 Section 3- Laboratory Performance of Printed Labels

Tests Passed	Test Methods	Clause Reference
Print Key Effectiveness	H,G	8.1
Abrasion Resistance	J,G	8.2
Permanence of Print	E,G	8.3

Label Construction Imaging:

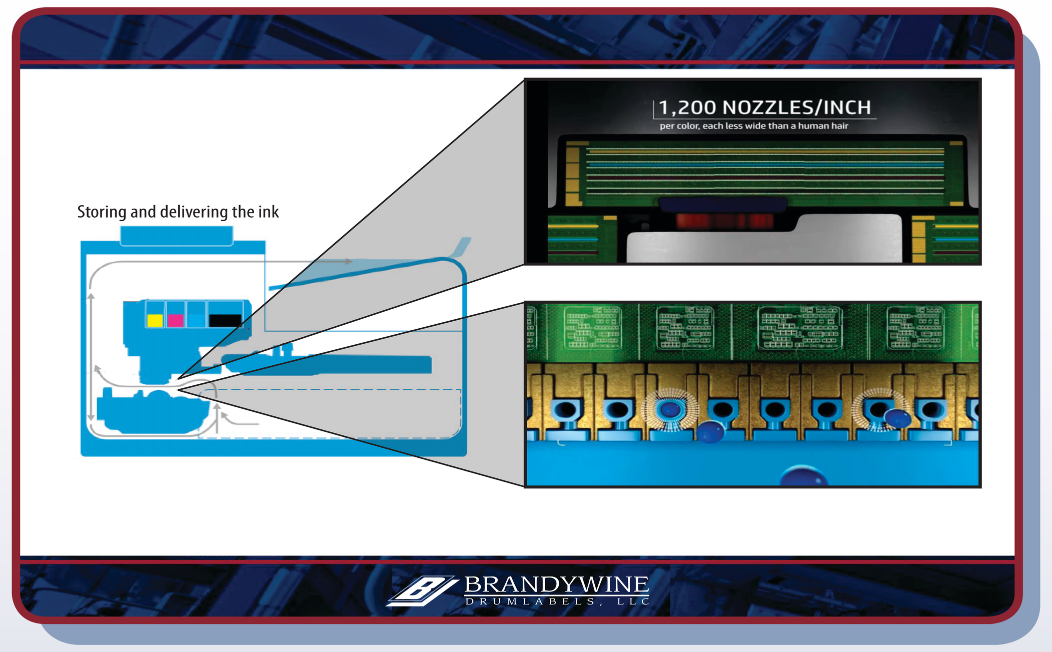
5 Mil White Poly-Twin EP™ Inkjet Imprinting: HP X4XXX; Epson 8XXX color printers, Neuralabel 300x

Conclusions



Because of durability and seawater submersion requirements the baseline for substrates in the labeling of chemical materials for transport and workplace considerations requires the use of a durable face stock. The selection of a color inkjet printing device must be made with this as the paramount consideration. The advent of pigment based wide array ink jet devices combined with specially engineered top coated film materials make this possible.

Unlike color laser toners, which are dry powders, inks are liquids during storage and delivery to the substrate, and they behave like liquids for a short time on the surface of the label surface. Once on the label, pigments must quickly immobilize to produce sharp text and lines and to achieve high color saturation and optical density. Since pigment based inks are composed of tiny colored particles, whose diameter is about a wavelength of visible light, they allow for the colorant to remain closer to the label surface enhancing the printed image. Using pigment inks as opposed to dye based alternatives allows for superior fade resistance, color saturation, black density, and solvent resistance on the label surface.



In addition, the surface coating of the label substrate is critically important. Liquid inks undergo complex physical processes and chemical reactions on the label surface. The printed image dries as volatile components of the ink vehicle (mostly water) evaporate and leave the pigments behind. The internal structure of the coating must allow for pigments to be held at the label surface and work together with the pigment inks to deliver best results. This combination allows for crisp images and vivid colors which are virtually indestructible, a critical consideration when producing hazard communication labels.

The research illustrates that color inkjet printing is a sufficient alternative to other types of on-demand color laser label printing. All of the tested labels were shown to meet or exceed current and proposed global standards for labeling chemical materials. The specific test results associated with this work demonstrate that the two critical determinates of successfully utilizing this technology are the selection of a proper pigment based inkjet device and a fully compatible certified compliant label substrate. Success in these two areas of the process will ensure that regulatory compliance professionals can achieve the dual goals of effectively communicating all hazards while minimizing risk to their organizations.