Effective Use of On-Demand Print Technology for the Creation of DOT Transport Diamonds

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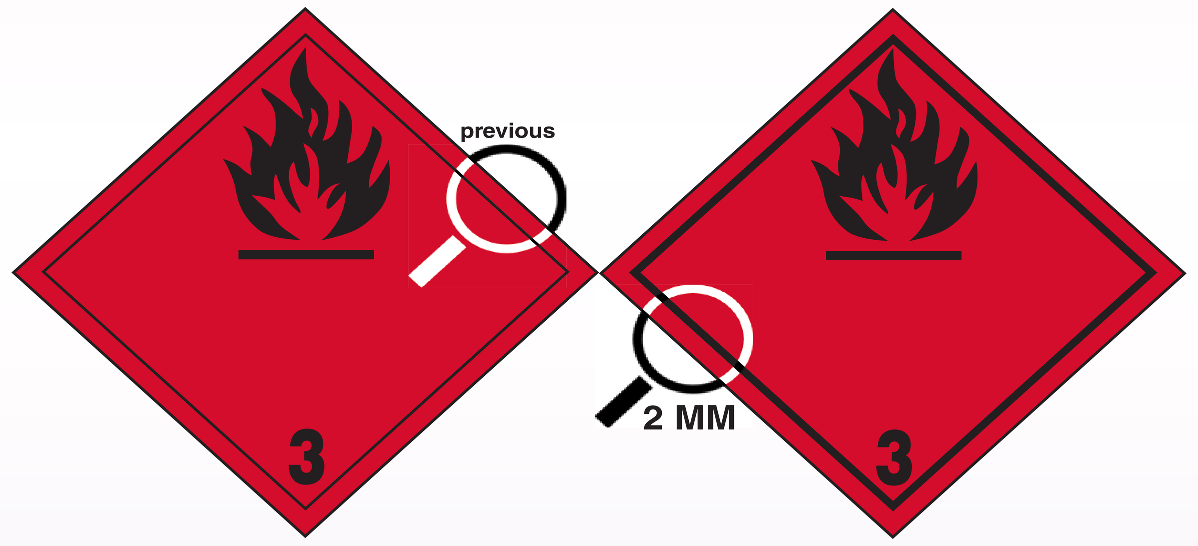
Abstract

On-demand color print platforms for GHS labeling have prevailed as the optimal choice for many organizations following the June 1, 2015 deadline. Adherence to evolving regulations, lower overall labeling costs, and shortened turnaround time are measurable benefits of the adoption of these print platforms. With the effective, efficient platforms being employed manufacturers and packagers alike are able to further leverage their devices and software to expand print on-demand utilization.

January 1, 2017 brought yet another change in regulatory requirements. The US Department of Transportation updated the graphics for transport diamonds with the implementation slated for January 1. The challenges faced by any organization using transport diamonds is ensuring all diamonds are updated, and continue to meet all aspects of DOT regulations. Regulatory compliance professionals are challenged with reviewing the updated standards and identifying a cost-effective solution. The testing protocol follows this process by referencing the applicable sections included in Title 49 Code of Federal Regulations to provide conclusive proof necessary to confirm that on-demand color laser and 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 printing device and pairing it with a 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 generation of DOT Transport diamonds when using color inkjet and laser generated labels.



Introduction

The United States Code of Federal Regulations has set forth an updated set of regulations regarding DOT Transport Diamonds. Section 172.407 outlines changes to graphics as follows, "(c) Size. (1) Each diamond (square-on-point) label prescribed in this subpart must be at least 100 mm (3.9 inches) on each side with each side having a solid line inner border 5 mm inside and parallel to the edge. The 5 mm measurement is from the outside edge of the label to the outside of the solid line forming the inner border. The width of the solid line forming the inner border must be at least 2 mm." This was to be enforced for containers labeled after January 1, 2017.
The June 2015 GHS deadline has proven to be a harbinger of change for hazard communication regulations. Many organizations utilize an in-house print on demand labeling platform for the creation of GHS compliant labels. CFR 172.407 presents an opportunity for those organizations to further leverage print technology, while granting the ability to nimbly adapt to evolving regulations, not limited to GHS or the US DOT.

Organizations must be certain labels utilized meet all updated regulations. This report pulls together those standards and regulations and follows the prescribed testing protocol outlined where provided or develops test methods demonstrating performance characteristics of color generated DOT Transport diamonds. The research here set out to establish whether color printing devices would enable Regulatory Compliance professionals to include DOT Transport diamonds in their organization's print on-demand label portfolio while at the same time ensuring their compatibility with all updated standards set forth by the United States Department of Transportation.

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:

2 Mil White Poly-Twin LX™; 5 Mil White Poly-Twin EP™; Laser imprinting: Lexmark CSXXX; Inkjet Imprinting: HP X4XXX; Epson 8XXX color printers

Toner anchorage – ASTM D5264-98

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® samples exceeded a 200+ value and the test was halted. >150 value is standard for flexographic printed substrates.

Label Construction Imaging:

2 Mil White Pol-Twin-LX™; 5 Mil White Poly-Twin EP™; Laser imprinting: Lexmark CSXXX; Inkjet Imprinting HP X4XXX; Epson 8XXX color printers

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:

2 Mil White Poly-Twin LX™; 5 Mil White Poly-Twin EP™; Laser imprinting: Lexmark CSXXX; Inkjet Imprinting: HP X4XXX; Epson 8XXX color printers

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

Test Protocol:

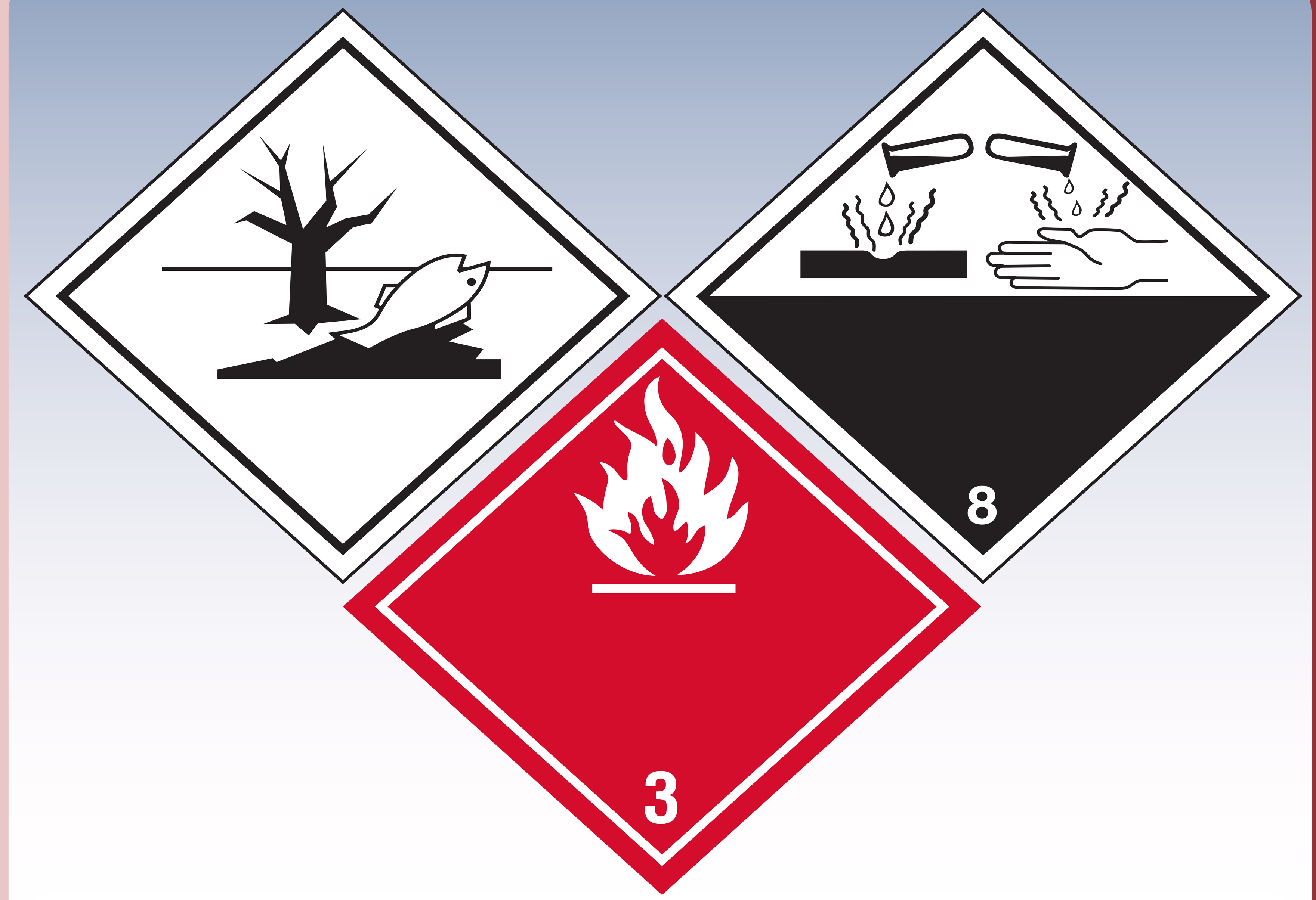
Test panels measuring 10 inches square were cut from the HDPE and Steel drums. Multiple samples of the label construction were hand applied at room temperature and rolled down with a 4.5lb. weighted steel roller covered with a Shore scale A durometer hardness rubber to the panels and dwelled 24hours 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



Conclusions

Because of durability requirements outlined in CFR 172.407, the baseline for substrates in the labeling of chemical materials for transport and workplace considerations requires use of a durable face stock. Testing indicates both color laser printing, and pigment based color inkjet technology are suitable methods for permanently adhering an image to the type of label stocks tested. To ensure suitable outcomes, the organization must take into consideration both label media and a color printing device.

The research outlined illustrates that on-demand color printing is a sufficient method to generate DOT Transport Diamonds. All tested labels were shown to maintain all current standards set forth by the US DOT.. Excellent anchorage and exceptional durability in conjunction with proper printing devices and label media, ensure that labeling meets all requirements for proper hazard communication.

The test results demonstrate that the two critical determinants of successfully utilizing this technology are the selection of a proper device, and a fully compatible certified compliant label substrate. Success in these two areas of the process will ensure the responsible parties will achieve the dual goals of effectively communicating all hazards while minimizing risk to their organizations. Because the changes outlined under Section 172.407 bring US standards more in line with the global GHS protocol they are likely to remain in place. The recently announced delay in implementation for new regulations announced by the incoming administration will allow more time for US companies to implement these changes.