How to Improve UV Ink Adhesion

The Océ Arizona GT and XT printers jet ink onto media where it is cured by high intensity UV lamps located on the printer carriage. UV-curable ink has advantages over heat-cured varieties, such as quick drying and a lower VOC (volatile organic compounds). However, the nature of UV ink in tandem with the properties of some common media may result in poor adhesion of ink to the substrate. While the level of bond required on printed output depends on the potential handling and usage, the bond can in some cases be improved to meet requirements. This bulletin provides some suggestions to improve UV ink adhesion.

Ink Types

There are 2 ink formulations available for the Océ Arizona printers: IJC 255 and IJC 256. IJC 256 ink offers improved adhesion properties on most rigid plastic media such as polystyrene, acrylic, foamed-PVC and to flexible materials such as coated banner and self-adhesive vinyl. This improved adhesion is most evident when trimming full bleed images, as edge-chipping effects are significantly reduced on most materials.

It should be noted that adhesion on fluted polypropylene, while better than IJC 255, is still not ideal. Although IJC 256 ink provides better edge chipping results, the use of an adhesion promoter such as Sericol ZE 720 is still necessary to eliminate chipping entirely as well as for mid to long-term outdoor print longevity, especially when printing high ink-load data. It is important to understand that IJC 256 is a purpose built ink, compositionally different than Océ IJC255 and therefore imaging results will be different. See Application Bulletin #28 for further information on the two inks. Bulletins are located at http://www.dgs.oce.com/

Adhesion Promoters

In most cases, cleaning media with alcohol or an alcohol and water solution will improve adhesion somewhat. If the chosen substrate produces particularly poor adhesion and a strong bond is essential, an adhesion promoter should be used. While there are many solutions available on the market, Océ Imaging Supplies offers the Fujifilm-Sericol family of adhesion promoters: #3010106598 Océ UV Adhesion Promoter 680, #3010105398 Océ UV Adhesion Master 720 and #3010109960 Océ UV Adhesion Ultra 700. The application table below gives an overview of which primers are best to use with each type of media.
If your media is not listed above, try using a primer indicated for use with a material that has a similar chemical composition. As always, please test the combination of primer, media and ink before committing to an application’s suitability. *Some media and primer combinations are not compatible with each other and media may be damaged irreparably.

**Corona Treatment**

Unlike most paper and board substrates, plastic materials do not have pores in the surface that allow ink to penetrate. The surface tension of the ink therefore must be lower than the substrate to allow for proper adhesion. The use of Corona treatment is an effective way to increase the surface tension of virtually any material. Corona treatment create an electrode spark, which passes through the substrate, increasing its surface energy. Oxygen molecules within the discharge area break apart and are free to bond to the ends of the molecules in the material being treated, resulting in a chemically activated surface. This method can be used on numerous substrates without damaging heat-sensitive plastics. The result is a surface unchanged to the naked eye, but one that is much more receptive to ink and other coatings. In-line treatment is the best way to ensure that the surface tension is in the acceptable range at the time of printing. The value associated with corona treatment is called a dyne and a general aim point is a dyne level of at least 40 dyne/cm².
Corona treatments will degrade over time if the material is not printed shortly after treatment. The rate of degradation depends upon the material and its storage conditions. Work with your supplier to ensure that freshly treated stock is available. Common corona treated media include polyethylene, polypropylene, nylon, vinyl, PVC, PET, metallic surfaces, paper, paperboard stock, and other materials.

UV Lamp Power and Print Modes

Generally, poor adhesion performance is seen with non-porous media on which ink has not adequately cured. This generality suggests that with most materials, increasing UV curing power will increase the inks’ bond with a substrate. This is especially true when printing more than one coat, as it is imperative that the first printed layer be fully cured before the second is placed. Once the uppermost layer has been applied, the bottom layer has little opportunity to continue curing. However, there is a point on some materials where over-curing may cause the ink to become more brittle and flaky when cut.

Working in combination with increased UV lamp power, reducing print speed will also usually improve adhesion. An ideal situation for greatest improvement of ink and media bond is high lamp power at the slowest print speed, Fine Art Mode. Also, if required the print speed can be further reduced by printing uni-directionally instead of bi-directionally. However, this combination of heat and speed may adversely affect media that is prone to warping, such as fluted polypropylene.

Ink that appears to be dry will continue to cure for some time after printing, which allows adhesion to improve. This is particularly true in the first 24 hours after printing, but can continue for up to 72 hours. For best results, delay trimming of adhesion-challenged materials during this post-print cure period.

In addition, if adhesion on previously known acceptable materials begins to deteriorate, verify that the UV lamps filters are clean, that the quartz window is clean and that the lamp bulbs have not exceeded the recommended 500 bulb life hours.

Other Possibilities

Profiling: Because adhesion is impacted by the level of curing that the ink obtains on media during printing, limiting the amount of ink used may be beneficial. Media Models and ICC profiles supplied by Océ have been created for general use on media, which may not be identical to your own. We suggest the creation of a media model for your chosen substrate and desired output result, with an emphasis on reducing ink load.

Heat: In the screen-press industry it is recommended to heat up the substrate before UV curing on those media where good adhesion is hard to obtain. Adhesion is improved when the substrate is heated with near-infrared light or far-infrared light for 15-90 seconds. We recommend all media at least be brought to print room temperature before printing.

Ink Jet Receptive Coated Media: Some media manufacturers and suppliers provide media which has been pre-treated with a coating that makes the surface more receptive to ink, or offer a “digital” or “graphic arts” version of the media which often has better adhesion than their regular stock. As well, the coatings are sometimes available for application by the user onto their own stock.

Top Coating: If good adhesion is not possible and the printed output is going to be handled, top coating the final printed piece with a protective sealer is an option. As with all fluids you
intend to use, application and handling testing should be performed before using on your chosen media.

**Trimming:** We recommend the use of Océ IJC 256 ink in a workflow where post-print trimming is frequently required, as edge chipping is greatly reduced with this ink set as opposed to IJC 255. When using IJC 255 ink, or if adhesion is still problematic when trimming in printed areas, pre-cut to the desired size and print full bleed. Always use a very sharp blade. A rotary cutter may provide a cleaner cut than a straight blade. When cutting with a digital cutter, experiment with speed, blades, and cutting from the backside. This can often reduce edge damage.