

Dye-sublimation / Resin Thermal Transfer versus Pigment Ink / Color Resin Card Printing FAQ

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1. What is “dye sublimation / resin thermal transfer” printing and what is “pigment ink” or “color resin” printing? What is the main difference between these printing technologies?

Dye sublimation / resin thermal transfer printing is a unique process that creates various continuous tone colors within one individual dot or pixel of an image. Dye sublimation / resin thermal transfer printing achieves this through a diffusion process that melds colors together into a smooth, continuous tone, capable of producing over 16.7 million colors.

“Pigment ink” or “color resin” printing, however, requires groupings of ink dots to signify one single color, lowering the resolution of the image. Color resin printing uses yellow, magenta and cyan to create only a limited range of colors when compared to dye sublimation.

2. Which printing method produces superior image quality?

Dye sublimation / resin thermal transfer produces a superior quality image over pigment ink / color resin printing.

The main reason that dye-sublimation printing produces better image quality lies in the fact that the dye sublimation process produces continuous tones that truly achieve the stated printhead resolution of the card printer, generally either 300 or 600 dots-per-inch (dpi).

Resulting images produced by dye sublimation technology are crisp and of realistic photographic quality. They achieve 600 dpi resolution by fully utilizing the capability of the printhead. This is because the dye sublimation process diffuses the dye, eliminating granulation while producing much greater image clarity. Dye sublimation printing essentially diffuses the dyes together into a single dot on the card surface, producing higher levels of resolution than is possible with pigment ink or color resin printers.

However, unlike the dye sublimation process described above, in the case of a pigment ink or color resin process, a single color is represented by a grouping of individual colored dots placed adjacent to one another, limiting the color range. The end result is that even though a printer using pigment ink / color resin printing may use a 600 dpi printhead, the actual quality of a color resin printed image remains at a standard 300 dpi. Because the color range is limited, images are not as brilliant – and as the end result is closer to 300 dpi, images and text will not be as crisp.

3. From a technical perspective, exactly why are dye sublimation images of superior quality over those printed via pigment ink technology?

Pigment ink / color resin printing uses pigment-based colors while dye sublimation uses dye-based colors. Dye inks *focus* light while pigment inks *reflect* light. Pigment ink particles are actually larger in size thus, have a tendency to scatter the light they reflect, which leads to less vibrant color.

In contrast, small dye ink particles reflect light evenly for more vibrant color. Because of this, dye-based inks provide superior image color and consequently, better quality images.

It should also be noted that some colors are not reproducible by pigment ink / color resin technology. Certain graphics, logos and specifically reproducible Pantone® colors are not available using color resin printing technologies. Dye sublimation printing technology utilizes color gradation more accurately. Therefore, images are clearer and better defined, allowing images with less contrast to be produced more accurately. This is important when creating small photographic images such as those typically printed onto identification cards.

4. I've heard that pigment ink / color resin printed cards are more durable and longer lasting than dye sublimation / resin thermal transfer printed cards because pigment ink printed cards are innately resistant to UV fading of text and images. Is this true?

Although it is true that pigment ink / color resin printing is naturally more resistant to fading from exposure to UV light over other printing methods, this does not necessarily mean that resulting cards are more durable or will last longer. They are still very susceptible to abrasion – meaning, images and text are still vulnerable to scratch-off.

If high durability and lengthening the lifespan of your cards is one of your priority card program requirements, pigment ink alone is not enough. To ensure card durability and longevity, you will want to laminate your cards to prevent damage or the scratching off of text and images.

Although pigment ink printing is more resistant to UV fade over time, this is of little importance when considering overall durability and longevity because while colors may not fade, without overlamine protection, images and text can easily scratch off, potentially rendering your cards unreadable.

5. Won't I save money on laminate consumables using a pigment ink / color resin printer due to the innate UV fade protection this printing method provides?

Vendors that manufacture and sell pigment ink or color resin card printers tend to position their solutions as being more affordable because they claim that resulting cards are overall more “durable” in terms of fade resistance without having to invest in separate UV-protectant overlaminates. However, as noted above, true card durability and longevity will be better achieved if cards are laminated.

Another cost consideration is the primer panel that is required for the pigment ink printing process. Unlike dye sublimation / resin thermal transfer printing, pigment ink / color resin printing requires an adhesive primer layer be applied to the card. This primer layer can add cost to your overall consumables investment. So, even if you decide that you don't need an overlamine, you'll likely still be spending more on consumables just to apply images and text to your cards using pigment ink / color resin printers.

6. I will be laminating my cards for added security and durability. How do these printing methods compare when paired with overlaminates?

If you will be applying overlaminates to your cards, an important factor to consider when selecting a printing technology is the adhesion of the laminate to the card. Significant efforts have been made by overlamine and reverse transfer dye sublimation manufacturers to ensure that the overlaminates remain securely fastened to the card.

In a preliminary test on a limited number of pigment ink / color resin-printed identification cards, the overlamine did not remain securely fastened to the card. This is mainly due to the fact that with pigment ink-printed cards, the resin lays on top of the card and accumulates to four layers of resin dots. This prevents the laminate from properly adhering to the surface, increasing the possibility of card compromise.

In contrast, overlaminates that had been developed specifically to work with dye sublimation-printed cards, did remain securely adhered. This is primarily due to the fact that dye sublimation printing impregnates the surface of the card, enabling more secure laminate adhesion.

With years of testing and field use, overlaminate failure on dye sublimation reverse image transfer cards has proven very unlikely.

7. What about output performance? How do these printing technologies compare in terms of print speed?

Because pigment ink / color resin reverse transfer printing requires an additional adhesive primer layer, this slows card output speed considerably as the printer needs time to apply this additional layer to complete the card printing process.

Pigment ink / color resin single-side printing (YMCK plus primer layer) typically averages about 36 seconds per card or 100 cards per hour. If printing dual-side, cards average about 55 seconds per card or 66 cards printed per hour.

In contrast, dye sublimation / resin thermal transfer printing is significantly faster. For example, in the case of HID Global's HDP® (High Definition Printing™) reverse transfer printers (FARGO HDP5600 or HDP5000) that leverage dye sublimation / resin thermal transfer technology, card print speeds average 29 seconds per card or 124 cards per hour for single-sided print jobs. Dual-side printing averages 40 seconds per card or 90 cards per hour.

Because there is no primer layer required for dye sublimation printing, card output speeds are significantly more favorable.

For organizations that regularly print cards in high volumes or frequently print large batches at a time, this difference can have a staggering effect on your card program's overall productivity. As such, it should be an important consideration when selecting the right printing technology for your organization.

For more information on the benefits of reverse transfer dye sublimation technology, read the white paper [Selecting the Right Ink Technology for ID Card Printing — What You Need to Know](#).

To learn more about how HID Global card printing solutions can bring security and convenience to your organization using the most advanced printing technology available, visit hidglobal.com/products/cardprinters/fargo/hdp5600.

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