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What is Dye Sublimation?

Dye sublimation technology is used by the majority of ID Card Printers and some Photographic Printers. And what is the difference with the inkjet printer?

This guide will give you the answers to all those questions.

Dye Sublimation printing...

Dye sublimation printing also known as dye-sub, has high quality photographic results. The printing process uses thermal transfer to transport coloured dye pigments from a carrier ribbon, or film, to the PVC printing surface to which the dyes bond chemically.

Inside a dye-sublimation ID Card printer is a roll of transparent film with a repeating series of **Cyan**, **Magenta**, **Yellow**, **Key (Black)**, and **Topcoat Clear** panels (**CMYKT**). The **CMY** panels contain thermally sensitive dyes corresponding to the three basic colours used in subtractive printing. By combining varying amounts of these dyes, any colour in the spectrum can be created, from white (no dye transferred) to Black (full transfer of each of the three dyes). The **Black** and **Topcoat Clear** panels are also used in this thermal printing process, but they operate in a different way called "Mass transfer" in which ALL of the material (In this case a plastic resin rather than a dye) is transferred once the carrier ribbon reaches the required transfer temperature. The black resin is used to apply dense black text and barcodes on top of the **CMY** colour image, and the clear panel is used to put a protective topcoat over the entire printed image.



Sublimation means to heat something and turn it into a vapor without going through the liquid phase. Because the pigments go from solid, to gas, and back to solid, there is little mess compared to inkjet printing which uses the liquid phase as part of the transfer process. Because of the way the vaporized dyes permeate the surface of the card, a gentle gradation at the edges of each pixel is created. Also, because the color infuses and bonds with the card material, it is less vulnerable to fading and distortion over time.

The thermal printing process uses a print head with hundreds of individual heater elements (typically 300 per inch) which are each separately controlled by software to transfer varying amounts of the **CMY** dyes and all or none of the **Black (K)** panel and the **Topcoat (T)** panel as the appropriate panel passes under it. In the case of the **CMY** panels, the individual temperature of the elements causes varying amounts of dye to be vaporized and to permeate the glossy PVC card surface where they form bonds with the plastic molecules.

The printer creates the card image by placing dye pigment and layers of acrylic resin onto the card in the following order:

- Cyan: (C)**
- Magenta: (M)**
- Yellow: (Y)**
- Black (K)**
- Clear overcoat (T)**



Dye Sub Printer
Datacard CP60

The coloured image is formed from a combination of the **CMY** dye panels, which are printed sequentially. The **K (black)** layer is used to form very sharply defined black text and barcodes and has the added advantage over **CMY** black that it is opaque to infrared which is required by barcode scanners. However, **CMY** black is normally used in graphics images on cards, because it looks more photo-realistic than the **K (Black)** resin. The clear **Topcoat** layer acts as a protective film against wear and UV fading.