TECHNICAL GUIDE

INK

SOLVENT, ECO SOLVENT AND UV-INKS COMPARED

Second Edition

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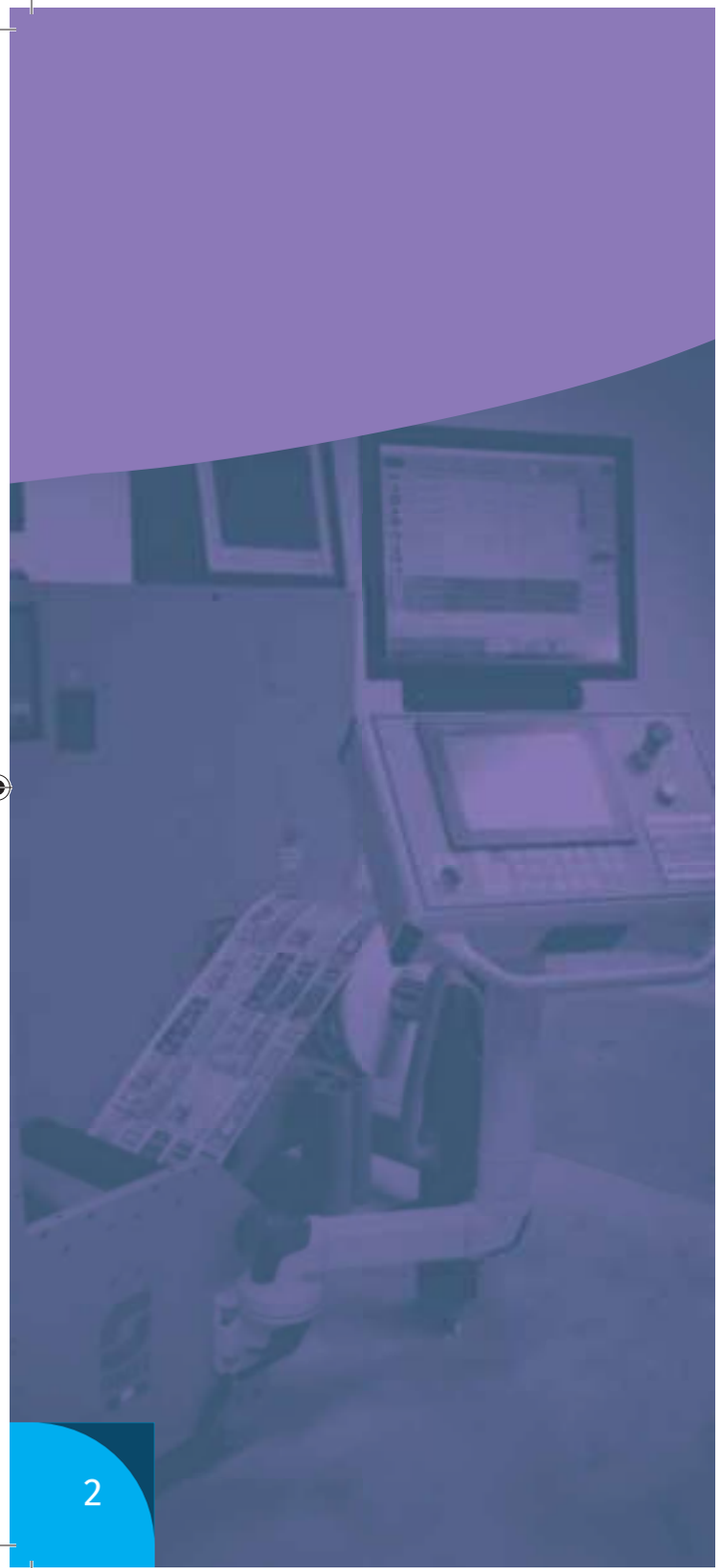


Solvent, ECO Solvent and UV-inks compared

In screen printing and large format digital print production, solvent based inks and UV-curable inks are amongst the most commonly used. Solvent inks range in the amounts of solvents used in the ink formulation and UV-curable inks offer an alternative to these formulations.

There are many reasons for the popularity of both types of ink. Both can be used on a wide range of different substrates, and both have good durability and water and weather resistance compared to conventional dye- or pigment based aqueous inks. The ink properties for both solvent and UV-curable inks are such that they support diverse applications, including indoor and outdoor sign and display work.

Solvent based inks have dominated the market for a long time, however UV-curable inks have risen in popularity in the last four or five years. One reason that it has taken a while for UV-curable inks to seriously compete with their solvent equivalents is that the solvent based inks were able to offer a much higher colour gamut than UV-curable inks. While this might have been true for the first generation UV-curable inks, more recent formulations of UV-curable inks can yield the same, and sometimes even larger colour gamuts, than those of solvent based inks.

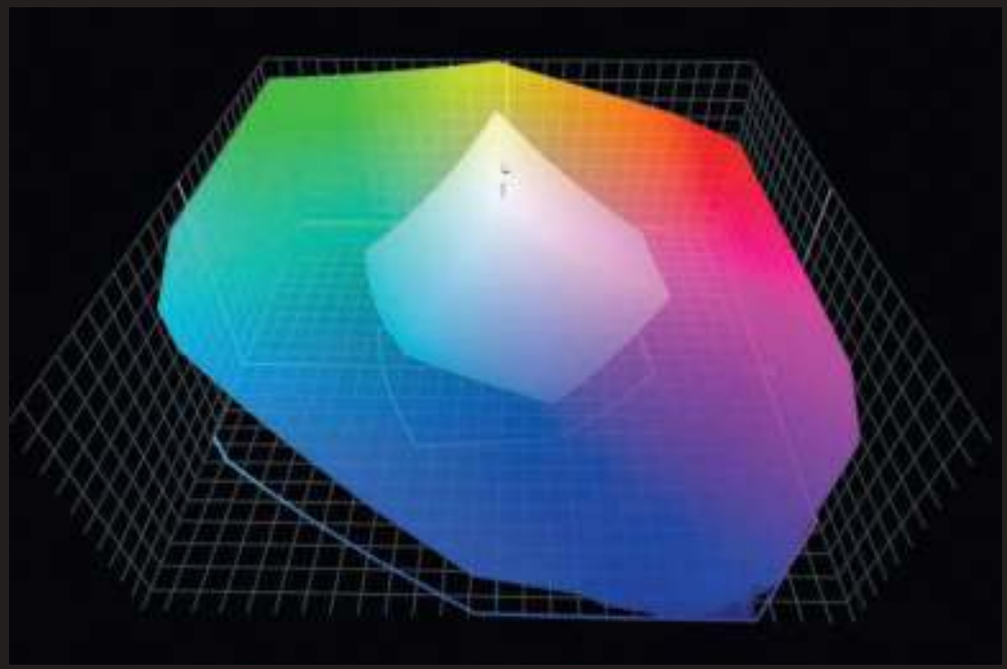
Classic repro wastes ink

As a reference comparison for what we can consider to be a large colour gamut or not, we can use the gamut of conventional offset printing on coated stock. This has a colour gamut of around 400,000 separate colours, which means those colours differentiated by a difference of 1 ΔE (Delta E). You can read many complex descriptions about how many colours the human eye can detect, or how many colours exist in real life, but graphic arts professionals prefer to use ΔE to calculate colour differences. The formula is a means of quantifying the visual perception of colour and was developed to support the work of the Commission internationale de l'éclairage (International Committee for Illumination, otherwise known as CIE). In 1931 CIE had developed a theoretical gamut volume, a colour space, of colours measured according to their luminance and their colour opponent dimensions. In CIELab, colour differences are calculated according to their ΔE differences. CIELab has become the most commonly used colour system in the graphic arts.

According to CIELab, a professional digital camera can capture about 2.3 million colours in a digital image, saved as red, green and blue signal data. The image file format ProPhoto RGB is said to represent this big colour gamut, which is roughly the same as the gamut of Camera RAW.

A very popular reference colour gamut is the Adobe RGB, which has about 1.2 million distinct colours. What matters for printers and their customers, is what colour gamut the printing system can offer on a certain substrate. The interplay of ink and substrate will obviously determine colour appearance, and so the image quality. The visual appearance must match the expectations of the print buyer, so ink and substrate selection should be made accordingly.

If we come back to the reference colour gamut of offset on quality coated stock, solvent based inks will normally exceed the 400,000 mark, often by quite some margin. This is why the image quality offered in solvent based printing systems has been regarded as being photorealistic. The output gamut doesn't necessarily match that of Adobe RGB entirely, but it still produces a visually pleasing, vibrant result with colours matching what the customer expects. This is important for brand colours but it is also important for overall quality requirements. The latest generation of UV-curable inks can



The colour gamut of a modern digital camera is about 2.3 million colours, presented here as a 3D model using ColorThink Pro software from Chromix (the coloured shape). As a comparison, the gamut of offset printing is about 400,000 colours, represented here as a greyish shape in the centre of the image.

generate colour gamuts of up to some 600,000 colours, and so they to are capable of producing near photorealistic results. It is simply no longer true that solvent based inks produce a larger colour gamut than UV-curable ink.

Choosing solvent

However there are other reasons why solvent based inks may still be preferred to UV-curable inks in some applications, despite the fact that they use Volatile Organic Compounds (VOCs) which are environmentally hostile and noxious chemicals. The UV-curable inks contain only limited amounts of these VOCs, which is why they are generally considered to be more environmentally friendly.

It should be remembered that depending on the particular ink recipe and curing system, these inks can require a lot of energy to cure. One application for which they are particularly suitable is printing onto substrates that need to be stretched to a quite extreme degree, as is the case in vehicle wrapping. While there are UV-curable inks that can be stretched to some 200% or more, this might not be enough in some applications so developers are constantly looking to expand their inks' stretchability.

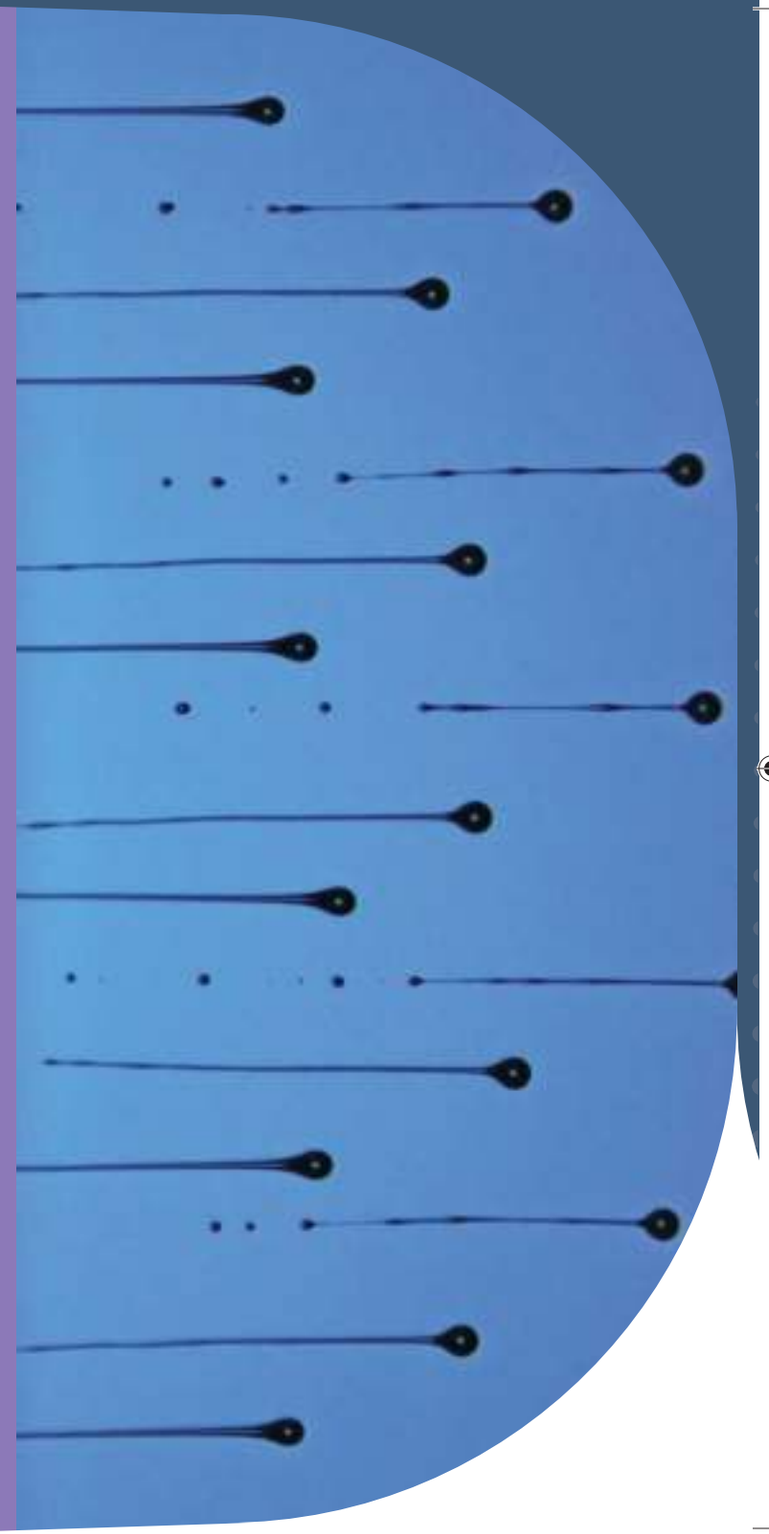
On the other hand UV-curable inks are instantly dry, while solvent based inks may need to allow solvents to fully evaporate before post press operations start. This process of gassing off can sometimes take up to 24 hours to complete, and this may well affect delivery times and margins.

In some applications the stretchability of an ink is extremely important, like for example when it comes to applying a custom coloured skin to a car.

Solvent versus ECO-solvent

For some time now several ink and/or press manufacturers have promoted Eco-solvent ink. The word eco is often interpreted to mean ecological, but it's not entirely clear if that is what was meant originally with this term. It might also be interpreted as meaning economical, as these eco-solvent inks contain lower amounts of solvents. They are therefore less aggressive than full or mild solvent inks. With a lower amount of solvent you should also have less odour, but this doesn't necessarily mean that the ink is entirely environmentally friendly. The eco-solvent inks are also claimed to reduce the amount of maintenance required to keep the printer running efficiently. A third reason to justify these inks as being more economical than real or true solvent inks, is that you might get away with a more simple, and so cheaper, ventilation system for the printer. However you might still have a considerable amount of VOCs emitted which will affect your operators, so it's probably wise to ensure proper ventilation, if nothing else for health and safety reasons. If in doubt, check the MSDS (Material Safety Data Sheet) supplied with the ink for guidance.

An alternative to eco-solvent inks is light solvent inks, or mild solvent inks, which are somewhat more aggressive than eco- solvent ink, but contain less harmful VOCs than true solvent inks. When comparing the properties between them all you should keep an eye on the durability you expect of the print, and particularly what the manufacturer states in the technical specifications sheet. True solvent inks tend to offer longer durability and overall robustness especially for outdoor applications. This is why they are worth the added cost, be it economical or environmental.



Solvent versus ECO-solvent

For durable outdoor production applications, solvent based or UV-curable inks have for a long time been the two main options. However now there is actually a third option. Latex based inks are a water based resin with some additional chemicals including synthetic microscopic latex polymers, pigment particles, humectants and wetting agents plus other additives. The water content can be well over half the ink's volume. They require no special ventilation, contain no Hazardous Air Pollutants (HAPs) and are non-combustible. When latex ink was first introduced there were some problems with scratch resistance, but the latest generation latex inks overcome this problem and these inks deliver an extremely robust finish. In this respect they combine some of the strengths of both solvent inks and UV-curable inks, while at the same time showing some environmentally friendly characteristics.

Latex inks use water so they have a high surface tension and low viscosity. The ink dries more or less instantly, however it does need the help of heaters and fans. They offer good outdoor durability and can be used on a wide range of substrates. Since they don't use aggressive solvents they don't need to be de-gassed, and so postpress activities can start immediately after the printing is finished. Some latex inks are also nickel free and so all-in-all fit well into a sustainable and environmentally aware business plan. The only possibly not so environmentally positive factor might be the energy consumption of heaters and dryers, but a calculation of energy consumption should be made for any machine used in print production, and then added to the overall matrix of what is sustainable or not.

The type of work you produce is the main driver for the type of ink you will use. This in turn is determined by what substrates your clients want you to print and the quality they expect you to achieve. But this still gives you some room for choices that can effect both your margins and overall profitability and environmental objectives, if this is important to you or your clients. In a perfect world you should be able to get both quality and profitability while choosing a sustainable and environmentally benign solution. The latter will be appreciated by both your staff and customers in the long run, and who knows could help your business to expand.

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