Anilox line screens – stabilizers of the ink film

Christopher Harper

In the previous article (FLEXO & GRAVURE ASIA 1-2005, p. 14) it was stated that anilox «volume» was king and that the language used in the pressroom should always be volume first! With the argument presented with reason and logic, the «line screen» of an anilox should always read second, or expressed as in the following example: »This job colour requires a 5 cm³/m² 236 l/cm (3.2 BCM's/600 lpi) screen anilox from inventory.«

Anilox volume is what creates the film of ink, which is used to print with - the line screen is a matrix of cells that provides the stabilizing force for maintaining the integrity of this film of ink. Like nuts and bolts, both are key to accomplishing the task. They are designed to work hand in hand.

Linescreen on an anilox is created by a laser engraving a pattern of cells (microscopic pockets that hold the ink) into a matrix that best supports the film of ink that creates the colour to be printed, influencing its physical thickness and the physical uniformity of the fluid film being transferred. The objective is to create and transfer the most perfect ink film for a given set of graphic and substrate conditions. It must be smooth, consistent and of the right thickness to achieve the colour target. If its too thin, the colour strength needed will not be achieved. If it is too thick - the colour will be too dark.

If it is not perfect for a given job requirement it may create a film of ink that has been bewitched into what I call a frog. These print frogs have been produced in many a print shop - and are the number one reason for print defects!

Big print-frogs in flexo can be seen with the naked eye - and commonly referred to as bar gain, dot bridging and dirty edge print. This can be caused either by the ink film thickness coming off the anilox roll being too thick (too high an anilox volume) or by too much plate pressure to the substrate and/or when picking up ink from the anilox roll. In either case or the combination of both, what's occurring at a microscopic level is «micro-splashing». The edges of the ink film are splashing outside the intended plate area.

Reviewing the illustration shown, it can logically be surmised that if the cell size or anilox roll volume is reduced there will be less likelihood of this micro-splashing occurring.

It was this framework of thinking that led to the development of the 800 cpi (315 l/cm) and higher line screens for anilox, today the workhorse for process printing. When concept development for these high line screens was under way in 1990, we imagined this problem was occurring on microscopic analysis of the print defect known as dot bridging, where one printed process dot was connecting with another on the printed surface. The only logical step was to reverse engineer the problem stopping the apparent build up of ink between the dots.

Typical field experience also showed that this phenomenon didn't happen when the job was started, but rather 15-20 minutes into the run. The logic for this is that even though the micro-splashing is not seen on the first print proof, it is happening. Once there is enough built up on the edge of the dot, it will begin releasing, sometimes occurring sporadically, to the printed surface. The solution to this was to take two steps. First to reduce the actual film thickness of ink being transferred and second, stabilizing it in such a way that what ink was there, wouldn't splash. This effort ended up into conceptual models as shown in figure 2.

This work proved a number of things never understood before in flexo. First, not only would higher line screens provide a stabilizing effect with the transfer process, but it would also stabilize the impression footings as the dot contacted the anilox roll surface.

The latter of these would soon be known to confirm the logical reasoning behind the famous 4:1 ratio of anilox linescreen to plate screen. This concept came about by chance when a converter found that a 100 line screen plate ran cleaner (less micro-splashing) when run with a 400 line anilox roll - yet back in those days it is important to note a 5% dot was typically the smallest imaged on a plate. However, what wasn't known was that in addition to stabilizing the impression zone or having more anilox cells under each dot as noted in figure 2, there was an automatic reduction in ink film thickness - thus micro-splashing reduction naturally resulted.

In fact, many today will argue that volume alone or ink film thickness, is actually the only thing that affects this, for instance making a 500 line screen at 3.1 cm²/m²(2.0 BCM). To a great extent they're right. Volume is the ultimate driver of print fidelity; however stabilizing the film of ink has proven to be key to long problem free print runs. Secondly, and perhaps as important, is the reproduction accuracy of the anilox roll when it is manufactured. Again, experience has proven that extremely shallow cell engravings in the production of an anilox produces greater variation of cell volume within the roll, and from one roll to another.

Figure 1: «Micro-splashing» - the edges of the ink films is splashing outside of the intended plate area.

Illustration Showing Micro-splashing and Approximately 50% Ink Transfers Phenomenon From Anilox Cells

Consulting Technologist, Harper Corporation.
Exploring the anilox ratio to plate screen

Today, the best anilox to plate screen ratio-rule-of-thumb would be 5 or 6 to 1, depending on how small the highlight dot is, i.e., 1% or 3%. As shown in Figure 2, a highlight dot needs a good footing in order to be properly inked. In the case of a 150 line screen plate, a 2% dot risks not getting enough ink, providing the logic for parcel dots showing up in print.

When compared to a 500 line screen anilox as shown in Figure 3, the impact and potential problems it produces in print can be seen. As shown here, the highlight dots are so small that there is a likelihood that they will hit a cell all by themselves, causing big micro-splash problems.

In short, by viewing graphic models of line screens against anilox rolls, it can quickly be seen which problems related to picking the wrong anilox for a given process job can occur. Note too that these same principles apply directly to the thin lines on bar codes, vignettes, and half tones.

Inks and savings

As for the ink? The stronger the better! Today, unlike the mid 90’s, ink companies have excellent ink strength that is slow drying. If something a little weaker is being used than that which the ink company offers to save a little money, then most likely the savings are being eroded and further losses are occurring in waste and down time.

Anilox inventory versus waste cost

Many today compromise buying an anilox roll they need to do the job right, and will spend these savings 10 times over in waste from the press. To confirm this, it suggested that all the printed waste rolls are weighed before they are disposed of or are recycled. Calculate the estimated cost per pound (or kilo) for just one week and then for a month. Take this number and then assume for a moment that this could potentially be cut in half. It might be surprising that providing the press crew with what is needed to do things right, the fast and easy way, saves a lot of money and reduces frustration on the press.

In the next article in this series, the ink release phenomenon will be covered in more depth and how this understanding is critical to specialized coating applications.

---

Figure 2: Anilox cell size to plate dot size.
1000 line screen anilox, cell opening 23.0 microns, cell wall 2.4 microns.

Figure 3: Anilox cell size to plate dot size.
500 line screen anilox, cell opening 46.8 microns, cell wall 4.0 microns.