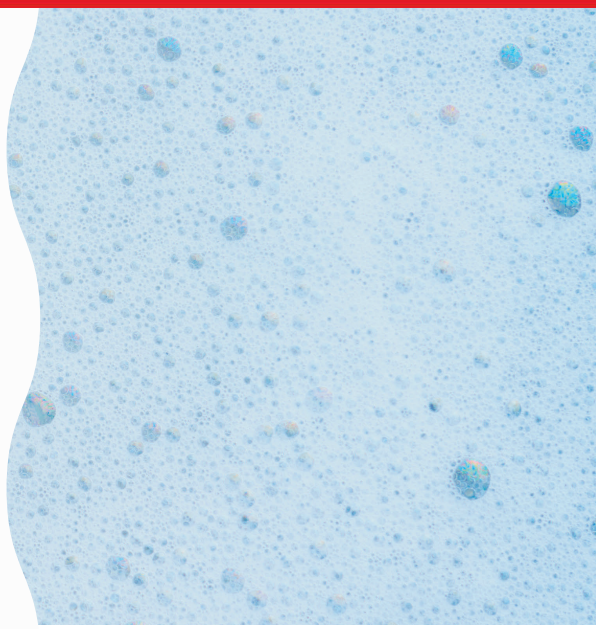
apex International

How to reduce INK FOAMING

Tackle water-based ink foam by switching your anilox

Water-based inks are known to be prone to foaming. As ink foam causes inconsistency in the print results, it is a problem that needs to be solved. When examining the causes and solutions of ink foaming, Apex revealed the impact of the different anilox surface engravings - and the significant importance.



The problem and solution

Ink foam is caused by the inclusion of air in the ink. This happens when water-based flexo inks are circulating in the ink system, where turbulence in the ink flow creates foaming – in much the same way pure liquid soap only starts foaming when we add water and then stir it. Many factors can cause turbulence in the ink flow, and all of these factors play part in solving the problem.

The flow of ink

The amount of turbulence in the ink flow, causing the ink to foam, depends on the design of the ink metering system. Let's take a closer look at some of the different segments in the system and how they affect the ink flow:

1 The ink pump

A dual diaphragm pump pulsates. This pulsation in combination with local obstructions in piping (e.g. fittings or pipe diameter changes) results in a turbulent flow of ink and thus foam. A peristaltic pump causes significantly less pulsation which causes more laminar ink flow and results in less ink foam.

2 The piping

Less piping, fewer fittings, and fewer differences in the pipe diameter in the ink system allow the ink to flow more laminar, resulting in less foam.

3 Doctor blade vs Rubber roll

Inside a doctor blade chamber, the ink flow is very turbulent. The ink inside the chamber will start rotating and become a liquid 'tornado' - and there might even be a vortex inside the 'tornado' due to the rotation. A rubber roll system is calmer and more gentle. Turbulence only occurs in the nip between rubber roll and screen roll that acts as an 'ink pump', forcing ink into the cells with real pressure. One also needs to look at the edge of a doctor blade striking over the screen roll surface. Pressure differences in the cells on the surface of the screen roll filled with ink will also result in turbulence and air inclusion.

4 Ink control systems

Ink control systems, e.g. for viscosity, pH, and temperature, that are added to the piping of the ink system will also result in additional restrictions in the ink flow and thus cause turbulence. Ink control systems should be designed in ways that prevent them from impacting the ink flow.

The impact of the anilox roll

Now, Apex wanted to establish how the engraving of an anilox - the screen roll that transfers the ink to the plate surface - impacts the foaming of ink and, more importantly, how this could help prevent it. To do this, an ink foam test was conducted to compare and evaluate the use of two different screen roll configurations:

- Conventional hexagonal engraving: ink film thickness (volume): 3.5 µm (cm^3/m^2), cell wall thickness: 4.7 µm, line count: 400 l/cm.
- Apex GTT2.0S with an ink film thickness (volume): 3.5 µm (cm^3/m^2).

The two screen rolls have the same ink film thickness (volume) on the surface of the roll. All tests were conducted on an MPS EF430 web printing machine. This machine is equipped with a doctor blade metering system where the screen roll rotates in an ink tray. The ink system consists of a feed pipe and a return pipe from the ink tray. The piping is short and has no restriction. The ink is pumped from the ink container causing a peristaltic pump. Considering all these factors, this ink system will very likely have a minimum impact on the ink foaming as the ink flow in the system is laminar. The ink system is also designed in such a way, that no water needs to be added to the ink. Thus the test is done with 'pure undiluted' ink straight from the container as supplied by the ink supplier. The MPS ink system on the machine used for the tests is ideal to evaluate the impact of the screen roll engraving on the occurrence of ink foam, as the only location for turbulence to occur in the ink flow is on the surface of the screen roll, where the doctor blade is in contact with the screen roll.

How to reduce INK FOAMING with GTT

Evaluating ink foam

The inclusion of air in the ink (foaming) causes the 'ink density', or 'ink weight', to drop. The measuring unit for ink density is kg/ dm^3 (please be aware that 'ink density' is not about 'color density'). Ink density/ weight can be established by taking a known volume of ink and accurately measuring the weight of this volume of ink. Dividing the weight recorded by the volume of ink dispensed is a value for the ink density.

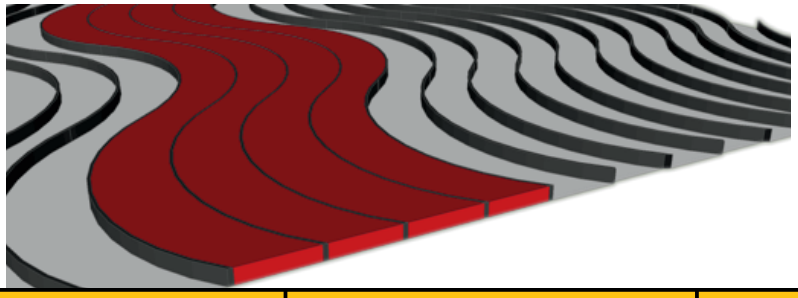
The ink weight was measured at the start of the print test series and at the end of the test. During the print tests the ink was circulated for 30 minutes in the ink system. For both screen rolls the identical tests were conducted and the same amount of substrate printed. A 100 ml ink sample was taken before the test and after the test. The weight of these ink samples were again measured 24 hours after the tests.

The impact of the anilox roll

The test results show that for both screen rolls the ink weight at the beginning is more or less identical to the ink weight after 24 hours. Also, note that the ink weight is measured at the start of printing, after the ink has been in circulation for 30 minutes.

This is nearly the same for both types of screen rolls. This shows that just the ink circulation has had little effect on the foaming.

The foaming occurs when the anilox is constantly being emptied of ink on to the plate, cells being filled with air and then refilled with ink again – all within just one revolution of the anilox. The clearly evident differences in foaming between the conventional hexagonal engraved screen roll and the GTT S anilox are shown by the ink density/weight readings at the end of the tests.



Screen roll	Ink weight at the end in KG/DM3	Ink weight at the start in KG/DM3	Ink weight 24h in KG/DM3
GTT S	1.085	1.082	1.078
Hexagonal	1.081	1.048	1.078

The table shows the ink density results

There are more than just ink density measurements collected from the test: the differences in ink foaming between the two types of screen rolls are visible as well, as these images show:

This test was designed to create the ideal ink circulation situation so that any ink foam occurring was likely only the result of the different screen roll screenings – and not influenced by the ink metering system.

Now, this was only one test using two screen rolls, having the same ink film thickness (volume) on the surface of the anilox. It is however safe to conclude that the ink foaming is significantly less (to none) for the GTT S screen roll, compared to the hexagonal screen roll.

Ink foam will be lower when using an Apex GTT screen roll. This will limit the need for anti-foam additives in water-based flexo inks, further enhancing the performance of the inks and the consistency of the print result.

GTT S

Hexagonal

Find out more about what you can do today about ink foaming.

Get in touch with our anilox experts via www.apexinternational.com or scan the QR code to download the Whitepaper.