How to stop UV Spitting

The numerous advantages offered by UV inks such as sharper graphics and richer colours, have made it the preferred ink by most narrow web printers. Unfortunately a phenomenon commonly known as “spitting “ that only occurs when printing with UV inks remains a major problem in many pressrooms.

Spitting is when the ink is sprayed on to the web in an uncontrolled manner. This is caused when the doctor blade lifts because of excessive doctoring pressure allowing the UV ink to pass under the blade and spit on the web. (Fig.1)

Spitting is a characteristic specific to UV inks as water or solvent based inks never encounter this problem. But what does cause UV spitting?

Many studies have been carried out along the years without any conclusive answer.

One contributor factor would be the higher viscosity of UV inks that can be five to seven times higher than water or solvent based inks.

Higher viscosity puts more pressure on the doctor blade making it to lift.

Another contributor is the thixotropic nature of UV inks. The viscosity of UV inks decreases when subjected to stress. Stress is applied to the ink when it comes into contact with the doctor blade. The sudden drop in viscosity at the doctor blade- Anilox point may allow the ink to flow underneath the blade resulting in spitting.

Understanding the possible contributing factors of spitting will help to find the solution to this costly problem.

Main contributing factors to UV spitting:

- High ink viscosity (1000-1900 cp)
- Print speed above 100mt/min
- Blade material, tip type and thickness
- Anilox volume and type of engraving

Changing Ink viscosity and print speed might not be a commercially viable option, however changing doctor blade and Anilox type is and it's a far more effective way to prevent and eradicate spitting.

DOCTOR BLADE

Main things to consider:

Angle and pressure

Recommended Blade contact angles for flexographic printing are between 25 degrees to 40 degrees with the optimum angle being near 30 degrees. Contact angles lower than 30 degrees are not very efficient and may leave some surface ink on the Anilox that could contribute to spitting. For UV inks the contact angle should be at least 30 degrees or higher to minimize UV spitting as a higher angle will resist deflection better.

Applying too much pressure to the blade will create a very flat angle that will cause the tip of the blade to lift off the Anilox surface, this will allow the ink to pass under this portion of the blade and transfer to the plate and to the substrate, causing spitting.

Thickness

A general rule of thumb in flexographic printing is always to use the thinnest blade possible while still being able to achieve a consistent wipe.

However with high viscous solutions, thicker blades have always been used as they resist deflection better, minimizing spitting. Using them in print applications could compromise quality as the thicker blade will provide a thicker ink film which will affect the definition and sharpness of the printed images.

New blades have been developed which are thicker at the base to reduce deflection but still offer the same quality of wipe as the tip of the blade remains the same.

Fig. 2 Doctor blade with thicker base. Image supplied By Daetwyler (One step blade).

By stiffening the base of the blade, the blade holds its position, allowing for a correct metering of the ink and withstands better the pressure posed by the UV ink which causes the blade to flex and therefore reduces significantly spitting. (Fig. 2)

Material

New polymer blades have been developed to combat UV spitting from a different field, that of the material surface energy.

Flexoconcepts TruOrange low surface energy polymer blade

The new polymer blades have a lower surface tension than steel. This decreases the attraction between the doctor blade and ink and reduces the amount of ink accumulated behind the doctor blade that can cause the blade to lift allowing the ink to pass through causing “spitting”.

ANILOX

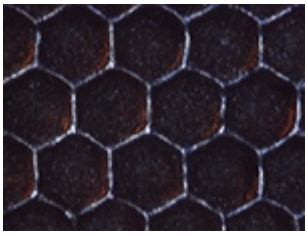

Fig. 3 60 degrees hex engraving

The Majority of Anilox used today are engraved with a hexagonal 60 degrees angle (fig. 3). Whilst its attributes and performance advantages over previous cell patterns are well known so are its limitations in terms of ink release and spitting.

Because of the ink release limitations of the hexagonal 60 degree pattern, a new range of elongated hexagonal cell engravings has flooded the market. (see fig. 4)

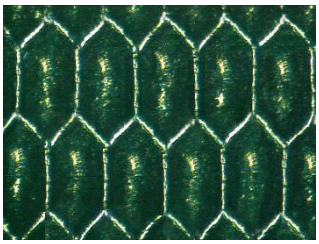

Fig. 4 Elongated hex. engraving

This new elongated hexagonal engraving is vastly better at ink release and transfer and therefore has become the preferred choice of many printers. However in the spitting front these engravings increase the amount of ink being transferred at the blade/ Anilox interface thus increasing the chance of spitting.

In both types of engraving the pattern created is a hexagonal closed-cell. As the cells are not linked in, the ink cannot not flow across the engraved Anilox surface as it rotates and the only way out from the cell is upwards. Due to its high viscosity , UV ink tend to accumulate behind the doctor blade causing the blade to lift allowing the UV ink to pass underneath causing the spitting.

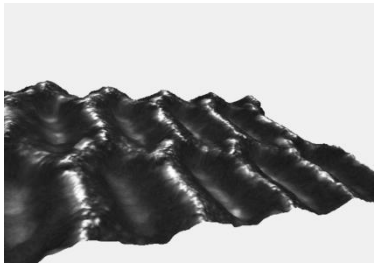

Fig. 5 MaXflo UV channel engraving

The use of channel engravings has proven to be an effective way to eliminate and prevent spitting. A channel engraving , either a continuous channel or linked-in cells (see fig. 5 and 6 respectively), allows the ink to flow within the engraved channel across the Anilox surface decreasing the build-up of ink accumulated behind the blade, thus reducing the hydraulic pressure inflicted to the blade.

Changing the Anilox specification from closed cell to channel engraving has proven to eliminate UV spitting in 99% of cases.

Fig. 7 UniFlo Continuous channel engraving

A study carried out in the last quarter of 2014 by Cheshire Anilox Technology revealed that the use of channel engravings, particularly MaxFlo UV, effectively eliminated UV spitting. Fifteen different UV label printers took part in the trial where four types of engraving were tested. All fifteen printers that participated in the trial currently encountered spitting in their operation, the different Anilox engravings tested had the same cell volume leaving the rest of print variables unchanged: the same doctor blade, substrate, backing tape, plate, print impression were maintained in each test.

The trial was double-blind, meaning that neither the printers nor the researchers knew which Anilox engraving was being used at the time of the print trial. The different engravings were referred as type A, B, C and D in order to differentiate and record data.

Different print speeds and viscosity of ink were tested to see results using different Anilox engravings. See fig. 8 for the results.

	ANILOX ENGRAVINGS USED			
PRINT CONDITIONS TESTED	60° HEX	75° HEX	30° CHANNEL	MAXFLO UV
SPEED <50m/min	✗	✓	✗	✗
SPEED >100m/min	✓	✓	✗	✗
INK VISCOSITY (1000-1200cp)	✓	✓	✗	✗
INK VISCOSITY (1201-1900 cp)	✓	✓	✓	✗

✓ =Spitting ✗= No spitting was encountered
(Fig. 8)

UV ink spitting is a common problem amongst UV label converters that can be successfully managed by following good operating and housekeeping practices but most importantly by selecting the right choice of Anilox.

Work with your Anilox, ink and blade suppliers to determine the best solution that works for you in order to minimize the potential of UV spitting.

About the author

Sonia Arcos is the Technical Sales Director of Cheshire Anilox Technology. She joined Cheshire Anilox technology in 2005. Sonia is a highly qualified professional with over 12 years' experience in the printing industry. Her strong technical knowledge and understanding of the flexo printing industry has proven very effective in assisting customers worldwide improving workflow efficiencies, print quality and productivity.