# REDUCING THE OCCURRENCE OF INK SPITTING.

White Paper

apex International

# SUMMARY

**In an attempt to answer a question as old as flexo itself, Apex International delves deep into the issue of ink spitting, carrying out lab tests to look at what influence the anilox roll has in reducing this costly and frustrating printing fault.**

## What is ink spitting?

Ink spitting is caused by a buildup of ink on the opposite side of the blade, which then leaks out from the blade or contact point, creating teardrop shaped flaws in the print. Ink spitting is a random phenomenon that impacts the overall quality and profitability of an otherwise perfect print.

## Why does it happen?

Ink spitting has been an industry headache since the introduction of UV inks into the flexo industry. With problems ranging from mild to severe, ink spitting is a frustrating issue that can vastly reduce the quality of the final print, increase waste, and decrease productivity.

The industry is always looking for ways to reduce ink spitting, but so far no one has been able to pinpoint the exact cause. There are several theories as to what might reduce or increase the changes of ink spitting, including:

- Doctor blade thickness
- Doctor blade angle
- Ink temperature and flow
- Anilox engraving
- Anilox surface finish
- Press set up
- Press speed

In truth any number of these alone, or in combination, can contribute to ink spitting. This creates a seemingly endless list of solutions for printers to try, which can be time consuming and costly.

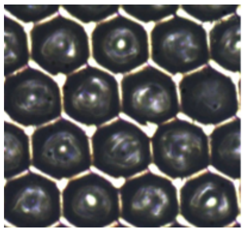
So, Apex decided to put some of these theories to the test, in a bid to contribute useful information to the ink spitting conversation, saving printers time, materials and money.

# PROJECT SCOPE

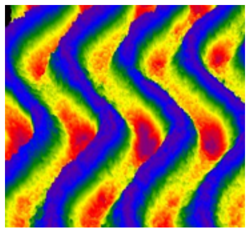
**We tested...**

- Doctor blade thickness: 0.15 mm and 0.20 mm
- Press speed: 30, 80, 120 m/m (100, 260, 395 fpm)
- Different inks: Process Cyan and Pantone 348
- Anilox surface polishing levels: 0-3

**... on these anilox**



H60 - 510 l/cm (1295 lpi)
H60 - 315 l/cm (800 lpi)
H60 - 120 l/cm (305 lpi)



GTT - S
GTT - L

## Polishing levels

Each of the five anilox were used 4 times during this project. After each set of testing (two inks, two blades, three ink speeds), the anilox were cleaned and taken back into Apex anilox production to receive additional polishing resulting in 4 tests of the following polishing depths, for example:

**Anilox 1 -**

- Polishing level 0 – 3.23 $cm^3/m^2$ (2.08 bcm)
- Polishing level 1 – 2.88 $cm^3/m^2$ (1.86 bcm)
- Polishing level 2 – 2.70 $cm^3/m^2$ (1.74 bcm)
- Polishing level 3 – 2.54 $cm^3/m^2$ (1.64 bcm)

This controlled process ensured that the level of polishing was consistent across all rolls. All three anilox rolls were engraved and created to the polishing level 0, using the same original cell engraving for each anilox roll. Additional polishing was only performed to achieve the desired cell wall structure and surface finish.

## Doctor blades

**SWED/CUT MICROFLEX**
Thickness: 0.15 mm
Lamella Edge

**SWED/CUT MICROKOTE G**
Thickness: 0.20 mm
Lamella Edge

## Substrate

**Ensuring consistent surface tension**

BOPP Pearlized 38 mic/Dyne Level 38 was used to check that a consistent level of corona treatment had been obtained prior to each test.

# TEST CONSTANTS

| | |
|---|---|
| **Printing press:** | **2020 state of the art in 432 width** |
| **Press speeds:** | **30 m/m (100 fpm); 80 m/m (260 fpm); 120 m/m (395 fpm)** |
| **Ink:** | **Flint FORCE™ UV - Process Cyan; P0348 Green** |
| **Tape:** | **tesa® SOFTPRINT 52016** |
| **Plate:** | **DuPont™ ESX - 1.14 mm thickness** |

The treatment level and the ink temperature were also tested before each test to ensure nothing was changing that could influence the results from those detailed areas.

## Test scope

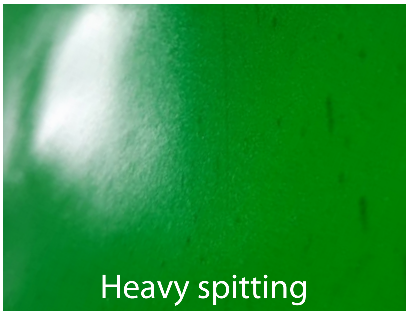
We carried out a total of 240 individual print tests over 14 days with 20,000 linear meters (65,600 linear feet) of substrate used.

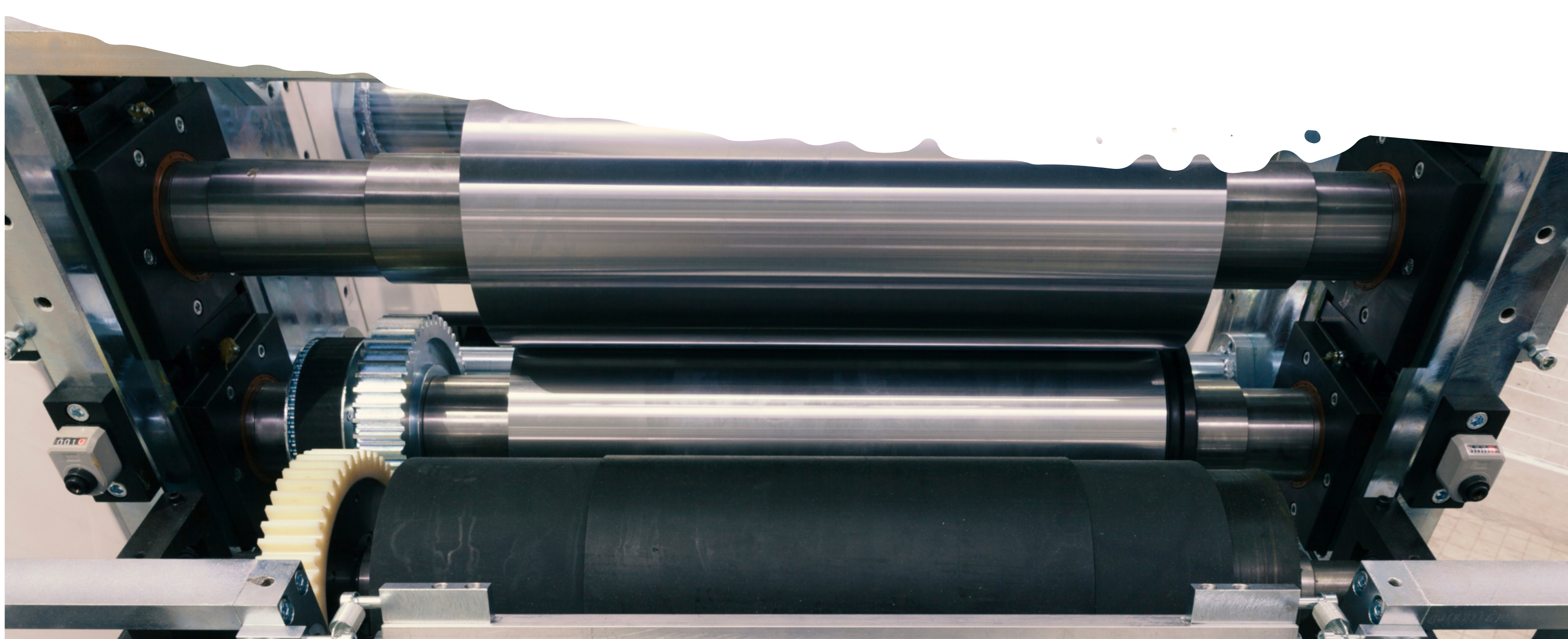
## Test parameters

We defined the results in 4 ways: zero spitting, faint spitting (visible only with back light), moderate spitting and heavy spitting.


Faint spitting


Moderate spitting


Heavy spitting



# THE RESULTS

## Anilox 1

**510 l/cm (1295 lpi)**

### Observation 1

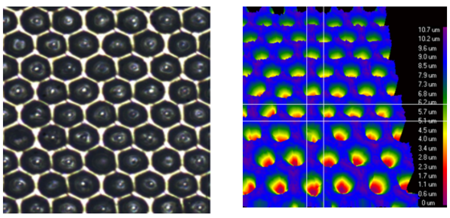
The two doctor blade thicknesses demonstrated no difference throughout all tests, polishing levels and ink selections.

### Observation 2

Effects of ink selection.

| Polish level | Process Cyan | Pantone 348 |
|---|---|---|
| 1<br>3.23 $cm^3/m^2$ (2.08 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - Faint spitting<br>Blade 0.20 - Faint spitting |
| 2<br>2.88 $cm^3/m^2$ (1.86 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - Faint spitting |
| 3<br>2.7 $cm^3/m^2$ (1.74 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |
| 4<br>2.54 $cm^3/m^2$ (1.64 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |

1



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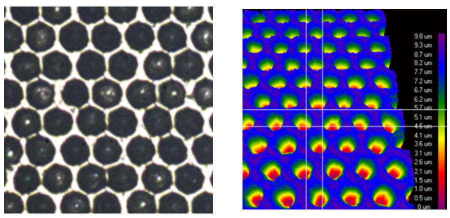

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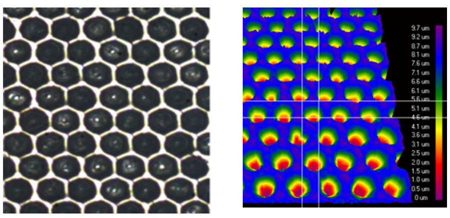

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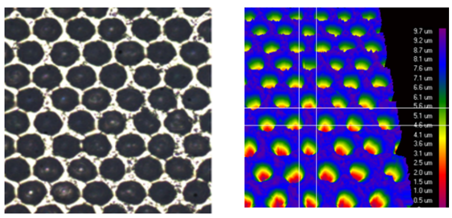


# Anilox 2

**315 l/cm (800 lpi)**

## Observation 1

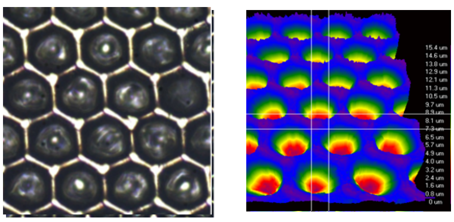
The two doctor blade thicknesses demonstrated no difference throughout all tests, polishing levels and ink selections.

## Observation 2

Effects of ink selection.

| Polish level | Process Cyan | Pantone 348 |
|---|---|---|
| 1<br>5.27 $cm^3/m^2$ (3.40 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - Faint spitting |
| 2<br>5.17 $cm^3/m^2$ (3.34 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - Faint spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |
| 3<br>4.98 $cm^3/m^2$ (3.21 bcm) | Blade 0.15 - Moderate spitting<br>Blade 0.20 - Moderate spitting | Blade 0.15 - Heavy spitting<br>Blade 0.20 - Moderate spitting |
| 4<br>4.06 $cm^3/m^2$ (2.62 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - Faint spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |

1



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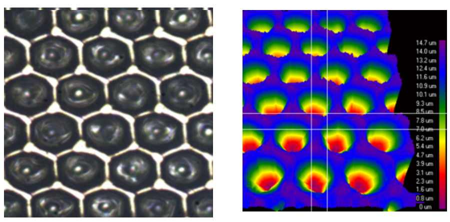

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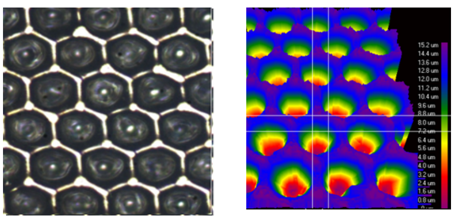

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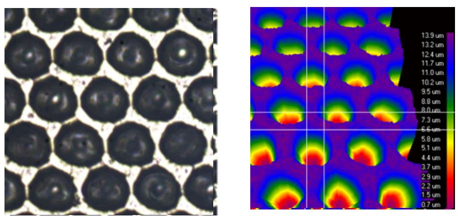


# THE RESULTS

## Anilox 3

**120 l/cm (305 lpi)**

### Observation 1

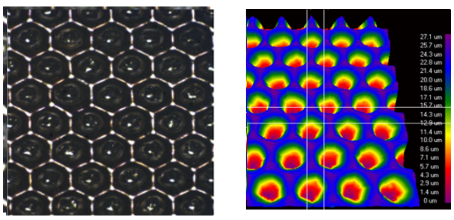
Throughout all tests, polishing levels and ink selections, the doctor blade thickness demonstrated no difference. Except in the case of polishing level 2 which performed differently resulting in moderate spitting with 0.15 thickness doctor blade.

### Observation 2

Effects of ink selection.

| Polish level | Process Cyan | Pantone 348 |
|---|---|---|
| 1<br>9.58 $cm^3/m^2$ (6.18 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |
| 2<br>8.99 $cm^3/m^2$ (5.80 bcm) | Blade 0.15 - Moderate spitting<br>Blade 0.20 - NO spitting | Blade 0.15 - Moderate spitting<br>Blade 0.20 - Moderate spitting |
| 3<br>8.28 $cm^3/m^2$ (5.34 bcm) | Blade 0.15 - Heavy spitting<br>Blade 0.20 - Heavy spitting | Blade 0.15 - Heavy spitting<br>Blade 0.20 - Heavy spitting |
| 4<br>7.3 $cm^3/m^2$ (4.71 bcm) | Blade 0.15 - Heavy spitting<br>Blade 0.20 - Heavy spitting | Blade 0.15 - Heavy spitting<br>Blade 0.20 - Heavy spitting |

1



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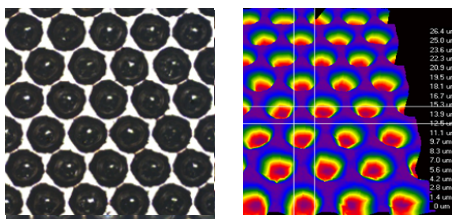

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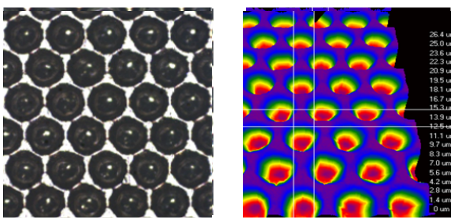

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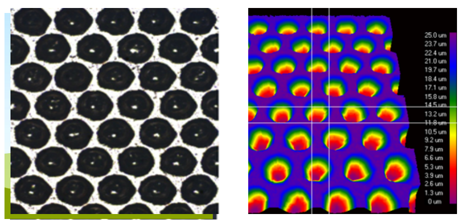
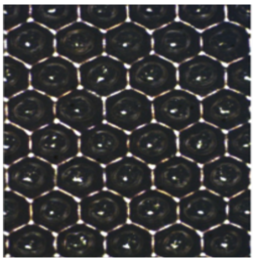


# THE EFFECTS

## The effects of anilox polishing on performance

**Very light polish:**
- Risk of score lines
- Quick loss of volume



**Heavy polish:**
- Risk of low density vs. volume
- Rapid anilox blocking
- Excessive cleaning
- Ink spitting

## The effects of doctor blade thickness on ink spitting

**Anilox 1:**
- The blade thickness had no impact.

**Anilox 2:**
- The blade thickness had no impact.

**Anilox 3:**
- The blade thickness changed the result on the polishing level 2 from high to moderate but did not eliminate the spitting.

### Blade thickness

The blade thickness can be a contributing factor, but differing blade thicknesses did not give a consistent benefit that could be considered a guaranteed solution to ink spitting.

### The effects of ink selection

So while the dyne level, doctor blade and ink temperatures all remained consistent, the two colours produced two different results which indicates that the ink rheology and formulation plays a significant role in the level of spitting observed.

# RESULTS GTT

## Anilox 4 & 5

### GTT S & L

**Observation 1**

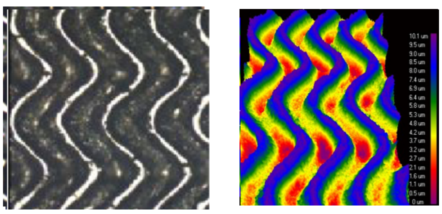
The GTT had no spitting regardless of speed, doctor blade or ink selection.

**Observation 2**

Effects of ink selection.

| Polish level | GTT S | Polish level | GTT L |
|---|---|---|---|
| 2<br>4.2 $cm^3/m^2$ (2.71 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | 2<br>7.56 $cm^3/m^2$ (4.88 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |
| 3<br>4.08 $cm^3/m^2$ (2.63 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | 3<br>6.56 $cm^3/m^2$ (4.23 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |
| 4<br>3.48 $cm^3/m^2$ (2.25 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting | 4<br>5.41 $cm^3/m^2$ (3.49 bcm) | Blade 0.15 - NO spitting<br>Blade 0.20 - NO spitting |

2 (S)



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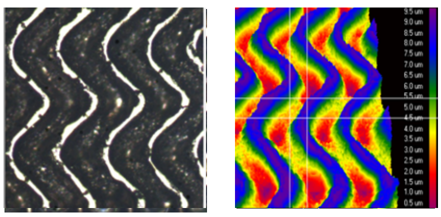

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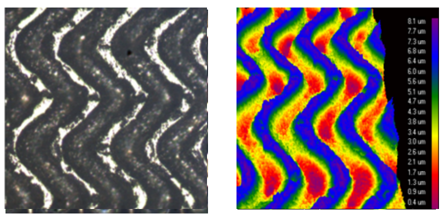

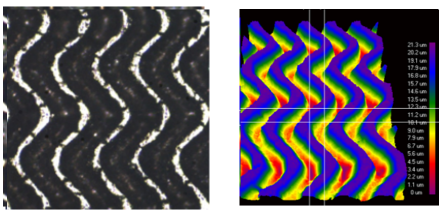

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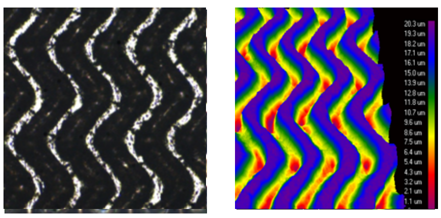

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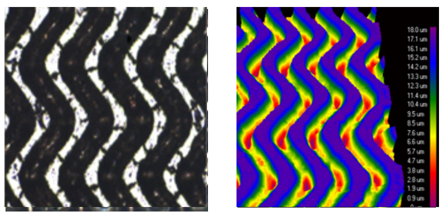

4 (L)

# CONCLUSION

**The GTT had no spitting regardless of speed, doctor blade or ink. This means that the mystery and time wasting with cell based anilox is not needed. GTT provides a stress-free production, allowing the printer to focus on the job of print quality and preproduction.**

The root cause of ink spitting is known to be complex and a moving target. Our tests have proven the value of cell-based engravings when tested under a "perfect storm" of combined process parameters with many combinations known to lead to ink spitting.

**From this extensive test it is evident that the best way to eliminate or drastically reduce the risk of ink spitting is to use GTT engraving technology.**

Choosing GTT open flow channel engraving drastically reduces the risk of ink spitting with UV inks. Open flow allows better movement of ink through the channels, resulting in lower pressure and therefore no ink build up on the back of the doctor blade.

**We have shown that GTT can be a complete solution that is able to control the many elements that create ink spitting.**