OPTIMIZING PRINT QUALITY FOR THE LONG RUN

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IT'S EASIER THAN YOU THINK

As the flywheel of flexo technology spins ever faster, there are many tools available today for corrugated box plants to invest in to improve their print quality. Whether it be prepress techniques, printing plate and imaging advancements, fast changeover presses, anilox roll engraving technology or most any other "bell" and/or "whistle" related to enhanced printing capability, they all provide a means of better control and consistency of image quality.

Whether or not an end-user accepts a print job is not solely dependent on image quality. There is another piece of the puzzle that is equally important to them. That oft times missing element is consistency of color.

There are two keys to achieving consistent color on press. The first is to have control of the inks, and the second is having an understanding

of the correct anilox roll engraving to be able to maintain control of the inks. Without a system in place to control the inks during a run, it is impossible to consistently print the same color(s) during that run. This begs the question as to how best to control the ink. The answer to that question is to control the ink viscosity. The common practices of dipping a paint stick into a bucket and observing how the ink runs down the stick or "just adding water" at some sort of perceived to be correct intervals are, I assure you, NOT methods of ink control. Without measurement or quantification, there can be no control.

When it comes to controlling ink and viscosity, think in terms of M.O.M. — Measure, Optimize, and Maintain. Doing these three things properly results in the inks being managed, and if anything is managed properly, it is then under control.

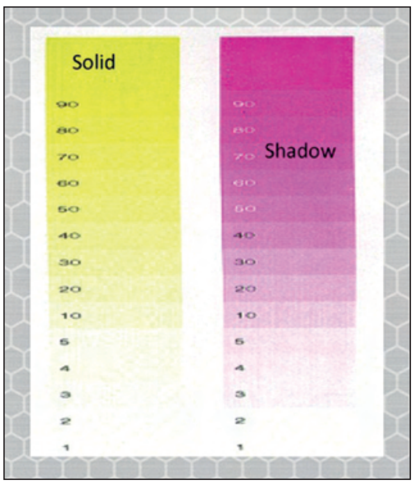
There are three tools needed to measure ink viscosity: an Efflux cup like a #2 Zahn, a timepiece like a stop watch or a wristwatch with a sweep second hand, and something to write/record the result on.

Calculating Print Contrast

After properly measuring the ink(s), the next step is to optimize it. There are reasons why this needs to be done. Many a press operator has said with all truthfulness that, "I did measure the ink and the viscosity is right," or "The ink runs good at 25 seconds so it must be o.k." While these statements may be accurate, they are not necessarily technically correct. It is a fact that the measurement tolerance of a new Efflux cup is +/- 1 second. So is it practical to think that an ink can be "right" at 25 seconds" viscosity if the accuracy tolerance of the tool used to measure it is greater than the specification? No, it is not. The ultimate question then is... What is the performance range of the ink(s)? This can be determined by calculating print contrast, which is a measure of how "open" shadow areas are in print. The mathematical formula to do this calculation is:

DS X 100 = P.C. %, WHERE DS IS THE MEASURED DENSITY OF THE SOLID, AND D70 IS THE MEASURED DENSITY OF THE 70% TINT.

MEASURING PRINT CONTRAST



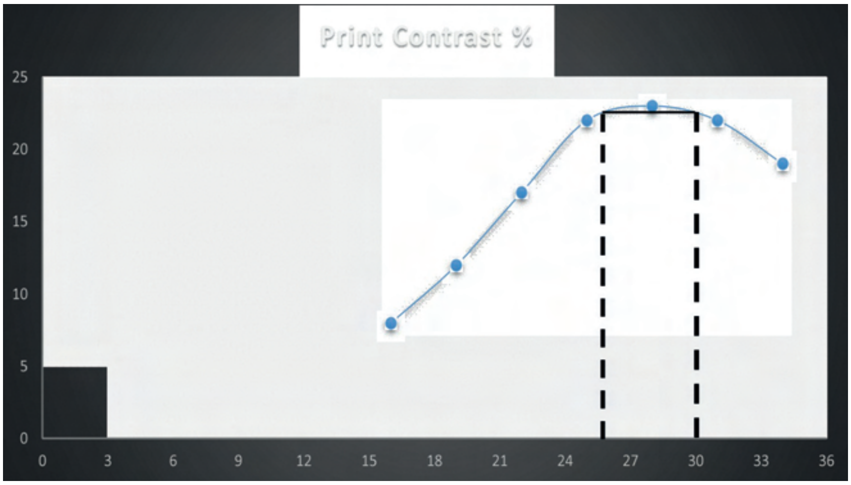
You are now probably thinking that this is flexo printing, not Algebra class and who is going to do this math. Actually, all color measurement instruments have print contrast as a function built into them so the calculations can be done for you. The answer to the question, "Why measure this?" is simple. Plant metrics such as waste, press uptime, downtime, and efficiency are all measured, maintained, and controlled, so why shouldn't it be done for graphics quality?

Only three things are needed to be able to measure print contrast on a printed sheet: a color bar or tone scale with a solid block and the 70% tint on the plate, a measurement device such as a densitometer, and once again something to record the result on.

It's important to note that for any printer doing higher end graphics work, having and using a color measurement device is a requirement. Without one, consistent printing and consistent color is impossible to achieve.

The point of this explanation of the print contrast function is that it can be used to determine the optimum viscosity range for the ink being used, where the measured density and contrast remain the highest for the greatest change in viscosity.

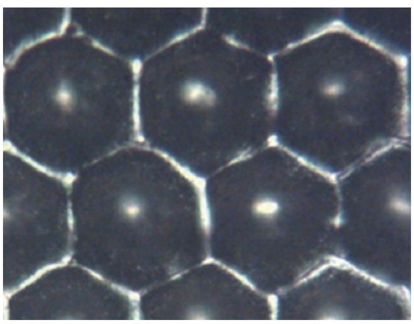
Optimizing the ink viscosity range needs to be done on only one of the process colors, typically cyan or magenta as the other colors typically run in the same range. The ink used to run this test should be set to run "heavy" or at high viscosity. After properly setting both anilox to plate and plate to sheet impression, run a reasonable number of sheets through the press, measure the contrast value, and document the result. Reduce the ink by 3 seconds, run more sheets, measure the value, and document again. Continue to do this in order to gather a total of at least 5 data points and plot a graph of the print contrast value related to the measured viscosity such as is seen below.



After plotting the graph, it's now apparent that the optimum viscosity range for this ink set is between 26 seconds and 30 seconds, as it is between these two points the contrast value remains the highest. There are other important lessons from doing this exercise. Since the ink will only move to a higher viscosity if untouched over time, all of the ink should be prepared and brought to press at the lower end of the optimum range. This means the ink will be truly "press ready" and will not require any adjustment as the job is started. It also allows the operator to wait longer to make a required ink adjustment, thus reducing the risk of "over adjusting" and moving the ink outside of the optimum operating window. We now have M.O.M. completely addressed. Ink viscosity is now Measured, it is Optimized, and because we have established the performance range, Maintenance within that range is much simpler. The ink is being managed and with that, it is controlled.

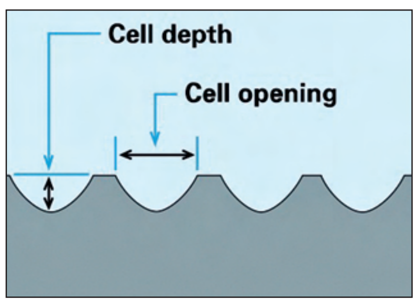
Anilox Engravings

The anilox roll engraving also has a lot to do with a printer's ability to consistently achieve the desired graphics quality and color, so it's important to understand some key characteristics of an engraving. The industry "standard" for many years has been the 60° Hexagon pattern.

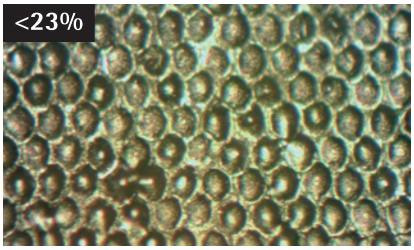


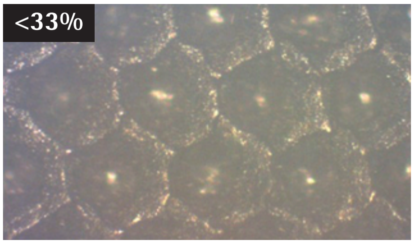
WITHOUT A SYSTEM IN PLACE TO CONTROL THE INKS DURING A RUN, IT IS IMPOSSIBLE TO CONSISTENTLY PRINT THE SAME COLOR(S) DURING THAT RUN.

They do work well and there are thousands still in use today. With this pattern, the key attribute is that of the cell cavity shape, ideally a parabolic or rounded "v" shape. This dictates how well ink can be picked up and delivered to the plate and how easy or difficult the roll may be to clean and keep clean. Because of this particular cavity shape, the 60° Hex does have a limitation; that being the volume range available for any particular cell count is constrained. In order to maintain that "ideal" cavity shape, there is a ratio of how deep the engraving should be relative to the size of the cell opening. It's the concept known as the Depth to Opening ratio, or D/O. If an engraving is created within that D/O ratio of 23% to 33%, the efficient cavity shape is maintained and good geometric cell quality characteristics result, both of which are required for good print quality.

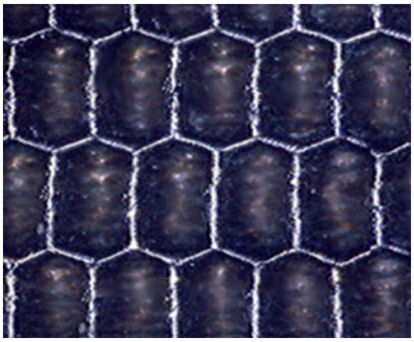


Should the D/O ratio vary too far out of that ideal range of 23% - 33%, engraving characteristics counter to those needed for good quality printing will result. As evidenced in the photos below, if the D/O ratio is <23% or > 33%; engravings with poor cell structure, inconsistent non-repeatable cell sizes and shapes that don't transfer ink well and are difficult to clean will result.





There is another engraving pattern available that is not influenced as much by the D/O ratio, which can help produce good print quality and consistent color over the course of long press runs. While still a 6-sided pattern, it is called an Extended Hexagon engraving. As shown in the photo below, there are two important differences between the conventional 60° Hex and the Extended Hex patterns.



By extending or stretching the hexagonal cells in the North-South direction around the circumference of the roll, there are many less angular cell walls compared to a standard 60 pattern. This results in less blade wear and longer life to both the blade and the anilox roll. Secondly, the cavity shape is more circular, which improves ink pick-up and makes delivery of ink to the plate much more efficient.

From a printing standpoint, the Extended Hex cell shape also has more "open" area at the very surface of the roll where it is needed most to get more ink, and a more uniform ink film delivered to the plate, both of which are important when printing on rough, irregular board. The absence of those many angular cell walls also creates more "space" or volumetric capacity so that the engraving can be produced to a shallower overall cell depth and still achieve the desired volume.

THE ANILOX ROLL ENGRAVING ALSO HAS A LOT TO DO WITH A PRINTER'S ABILITY TO CONSISTENTLY ACHIEVE THE DESIRED GRAPHICS QUALITY AND COLOR.

This makes rolls engraved with an Extended Hex pattern easier to keep clean, reducing the volume (and hence color) loss over time as the rolls become plugged with dried ink as is common with many conventional engravings.

Extended Hexagonal engravings also have volume ranges that are not constrained by the D/O ratio. Higher volumes can be achieved at higher cell counts without sacrificing geometric cell quality and efficient cavity shape. The advantage here is that good color and coverage can be attained from the higher volume while at the same time the higher cell count provides for proper halftone dot support and more cleanly printed screens and vignettes. The table below shows the maximum volume attainable at particular cell counts for a conventional 60° Hex and the Extended Hex pattern.

EXTENDED HEXAGON

60 Hex /Volume	Extended Hex/Volume
800/2.2	800/3.2
700/3.0	700/3.5
550/3.2	550/4.8
500/3.5	500/5.2
360/5.0	360/7.2
330/5.4	330/8.0
300/5.8	300/8.2

Consistent graphics quality and color can be achieved over the long run only if the inks used are measured, optimized, maintained and controlled, and the anilox rolls selected have the "right" geometric and cell cavity shape characteristics. ■

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