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Effect of anilox features on Print Parameters

Dr. R R Deshmukh

Professor, Mechanical Engineering Department,

JNEC, MGMU, Chhatrapati Sambhajinagar. (MS) India.

Mr. Parag Hase

Assistant Professor, Department of Printing Technology,

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar. (MS) India.

Abstract:

The anilox roller is the key roller in flexography. But, it carries different characteristics, which reflect upon the performance of printing. In the most consumer packaging companies and print-buying customers now require specific print targets for their products-darkness, dot-gain percentage and/or Delta E color tolerances. The push for more consistency, higher-resolution graphics and faster turnaround of products continues. Thankfully, there are numerous methodologies available for quantifying the print process regardless if it is measuring darkness, dot gain, near-neutral darkness or using G7 standards.[1] By using a tried-and-true scientific approach to select your anilox inventory-band-roll trials-one can correlate anilox specifications directly to any print targets and tolerances.

Keywords:- *printing technology; production; technical, performance.*

Introduction

Every anilox roll manufactured by this firm is measured and engraved using an EDV Echotopography (Interferometric) Digital Volume measurement system. This approach has dramatically improved print consistency by assuring a quantifiable, manufactured ink-delivery engraving and has narrowed the window for achieving print tolerances, resulting in a high level of quality products. With today's Interferometry technology, printers have the ability to use a measurable, quantifiable approach for the selection of anilox-engraving specification that correlates directly to print targets and tolerances. Printers can use the Interferometry measurements supplied with each anilox roll to document anilox

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specifications, digital microscopes to measure the polymer and spectrodensitometers to measure print targets and tolerances (see Figure 1).

FIRST Density - Starting Targets				
Color	C	M	Y	K
Paper Products	1.40	1.30	1.05	1.55
Film Products	1.35	1.25	1.05	1.45
News Print	1.02	1.00	0.84	1.10

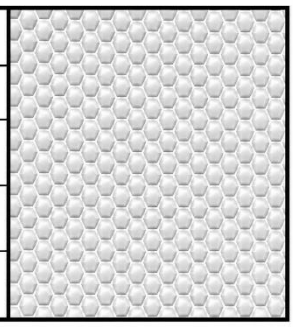

FIGURE1. Anilox Engravings Correlate to Print Targets/Tolerances

Printers that do not have or use print targets need to choose one. Without targets, you have nothing to measure; without a quantifiable process you have a high degree of variability and inconsistency. A good source for print targets is the FIRST 4.0 manual.[2]

Banded-roll print trials will result in tight controls for the print process starting from the heart of flexography-the anilox roll, and then scientifically correlating directly to print targets and tolerances. This quantifiable approach is effective regardless if you are doing banded-roll trials for process printing, line/solids, combination printing or for coatings. Coatings require specific coat weights to work successfully, that as with normal printing, correlates directly to the anilox-roll specifications.

Measurement methodology:

Process printing enables a high quality of graphic reproduction, almost photographic. When printing, there must be print targets and tolerances for the entire process, including ink formulation and viscosity, plate thickness and dot consistency, sticky back choice and press condition-impression settings, production speed to consistently achieve production goals. It is also important to define the measuring methodology. Are you measuring darkness, dot gain, gray balance or Delta values?

To measure the concerned values is an essential task. But, how will you measure is also a significant thing. The parameters of the measuring device are also important. Defining measuring methodology is vital to conducting a successful print trial and achieving consistent results.

Banded anilox rolls allow testing of all print variables for daily print production and are also the best way of testing updated engraving technologies side-by-side with your current anilox specification. When conducting any print trial, including a banded-roll trial, it is imperative to

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have benchmarks against which results are compared. This is especially critical when comparing current anilox specification to updated engravings. It is easy to claim that an updated engraving technology outperforms another when the older roll is worn or plugged.[3] Additionally, when comparing any change in the print process, use visual as well as measurable targets to decide if the change is truly better.

One-to-one testing:

Considering the turnover of flexography industry as of now, there are numerous engraving styles. A word of caution: Conduct comparative one-to-one testing. But, all the updated anilox manufacturing processes are not effective and result-assuring. Over the last several years, our firm's technical team has conducted countless banded-roll trials and tested all available anilox engravings. No engraving has surpassed the performance of 60deg Hexagonal cell engraving when the test is structured with a one-to-one comparison of equal volumes. This is due to the high precision of the hexagonal structure and the fact that the hexagonal shape allows for 15-percent more cells in a given area.

The 60deg Hexagonal engraving covers more than 75 percent of most the consumer product printing firms.[4] This type of engraving offers the highest degree of consistency and repeatability for matching print tolerances from job to job and press to press tied directly to print tolerances for coatings, darkness and color.

This banded-roll trial involved comparing the Extra Large 70deg Hex, compared to long-cell engravings, compared to the XLT-60deg Hex. It was conducted using process Cyan UV ink with digital polymer imaged at 185lpi, printed on a mid-web press and using an anilox specification for all three different cell shapes engraved to 1,000cpi (or equivalent), 1.8bcm, +/-0.1bcm. The print trials conducted compared digital-polymer plates imaged at 160, 185 and 225lpi with all three engravings. For the 160-lpi plate, dot gains were a little lower — all within 2 - 3 percent of each other; solid ink darkness, like the dot gain, was similar and within +/-0.056 darkness. For the 225-lpi print trials, the solid ink darkness was within +/-0.056 darkness and the dot gain was overall a little higher, but all within 3 percent of each other (see Figure 2).

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60 Hex vs 70 Hex/900cpi, 1.65 bcm, 190lip, 400ft/m

Dot Gain %	60 Hex	70 Hex	Baseline
0	0	0	0
6	7	6	5
12	13	12	10
18	20	18	15
24	27	24	21
30	34	31	27
36	41	37	33
42	48	44	40
48	55	50	46
54	61	56	52
60	67	62	57
66	72	68	63
72	78	73	68
78	84	79	73
84	89	84	78
96	93	89	83
102	97	93	87
108	100	99	91
Density	2.45	2.35	2.15

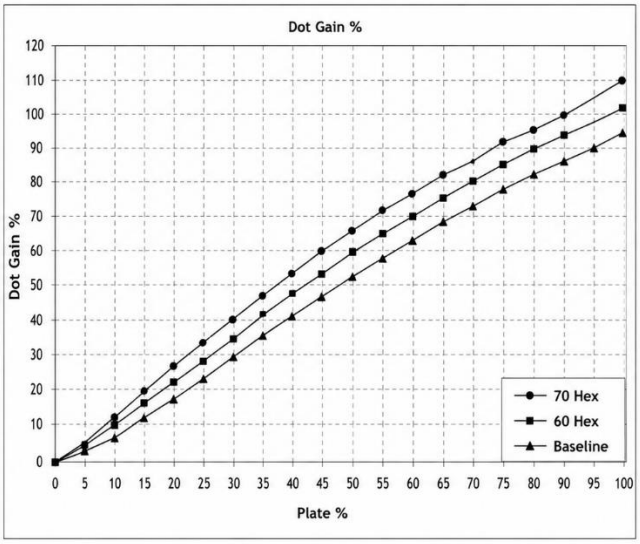

FIGURE 2. Darkness and dot-gain results of 185-lpi print trial

Channeled engravings:

Today, the flexo industry is abuzz regarding a variety of channeled engravings promoted as updated. Variations of channeled engravings are and have been available for quite some time. Some of these are tri-helical engravings-45, 75 and 89deg; weave engravings; hourglass or quad-type engravings and other types. If you are interested in using any updated engraving, take the time and conduct print trials to determine specific results.

Channel engravings are more applicable to solids, coatings or specialty inks, such as fluorescents and metallic. Again, quantifiable approach should be your avenue to determine the results when comparing updated engravings to current anilox-roll inventory.

It is combination of linework and halftone narrow-web print trial comparing 60deg Hexagonal engraving to channel engravings-89 deg and weave channel. This test involved an opacity print trial that tested white ink in a wide-web format for surface print. The protocol used medium-durometer sticky back and a hard-durometer plate with solvent-based white surface-print ink. Ink viscosity was maintained around 22 secs, and the substrate was 2.0-mil clear film. An XLT-60deg Hex was compared to 30-deg Channel to the weave channel with engraving specifications around 9.0 bcm (see Figure 3).

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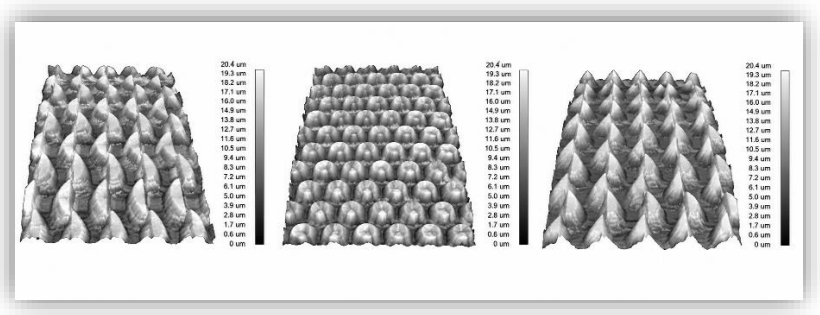
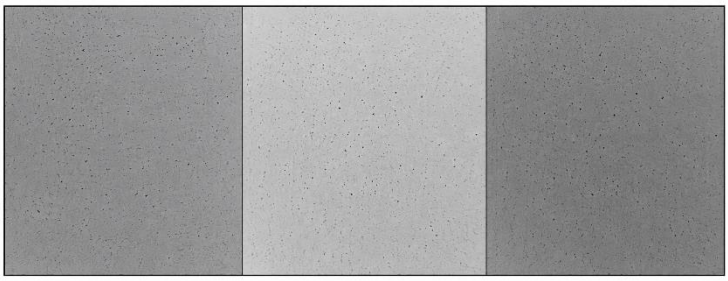


30 degree *60degHex* *Weave*

FIGURE 3: Comparison of XLT-60 deg Hex,30deg Channel and Weave

The press was run at 1,000 fpm (305 mpm). Samples were evaluated from the start of the print trial, mid-way through and at the end of the press run, visually against a backlighted table and by measuring the opacity of the different engravings. Measuring methodology used: L-value of the spectrodensitometer measured against the black area of a Leneta Opacity Board. Visually, it was difficult to discern a difference between the three different engravings. Measurements were taken using the spectrodensitometer with the black area of a Leneta board as a backing. Average Opacity readings are shown in Figure 4.



60 deg Hex – 9.0 bcm
62.25 Opacity

30 deg Channel – 9.0 bcm
82.05 Opacity

Weave – 9.0 bcm
77.52 Opacity

FIGURE 4: Average Opacity ratings for print testing of three anilox-roll engravings

Print-trial guidelines:

Several points should be kept in mind when conducting any print trial.

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a) It is critical to define the variables you seek and always compare them to a known target or standard.

b) Always have measurable print targets. There is no value to conducting a test comparing an updated engraving to an old engraving, if you have no way of measuring the results.

c) Always use clean aniloxes. Dirty anilox rolls will dramatically skew the print results.

The following are potential challenges to consider when testing with updated engravings:

Too much color due to excessive volume

Plugging of screens used with vignettes

Plugging of minimum dots due to too much flowing ink

Consistency of anilox engravings

Hitting your measurable print targets

Print patterns due to moiré

This is by far the greatest factor when thinking about converting to a different engraving technology, especially when attempting to use the same specifications on multiple presses. Selection of anilox specifications should be based on desired print targets which, in turn, should be established for every aspect of your print needs-process, line/solid, whites and coatings.[5]

Anilox specs should be defined and tracked throughout their use to determine when they no longer achieve print targets. The length of wear for an anilox roll will differ depending on frequency of use, speed of the press and type of ink.

Conclusion:

Today the flexography has changed in many ways considering the industry requirements. Yet, Anilox form the significant role in the production process of labels and packaging, giving a greater relief to achieve targeted densities. Therefore, it is very important which type of anilox roller you are going for. Knowing the combinations of line screen and volume of anilox rollers, shall assist in broader way match required print targets and tolerances. A press running at 1,500 fpm (457 mpm) will clearly wear out aniloxes faster than one running at 900 fpm (274 mpm). This is especially true for aniloxes that are used for process printing. The engraving specifications for process printing continue changing to higher engravings. In flexible packaging, anilox specifications typically had ranged from 700 to 800 cpi; today that engraving specification is changing to 850 to 950 cpi. By tracking your print targets, and having frequent anilox-inventory audits, we came to know at what point the anilox

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specification will no longer hit the required print targets. To maintain high level of print quality consistency, one needs to keep regular maintenance of the anilox rollers.

References:

1. ISO/DIS 3664, *Photography-Viewing Condition-Photographic Prints, Photomechanical Reproduction and Transparencies*, International Organization for Standardization, 1987.

2. ISO/DIS 12640, *Graphical Technology-Prepress Digital Data Exchange-CMYK Standard Color Image Data (CMYK/SCID)*, International Organization for Standardization, 1997.

3. Donderi, D.C., *Information Measurement of Distinctiveness and Similarity*, Perception and Psychophysics, 44(6), 1998, 676-584.

4. Donderi, D.C., *Proscale 3.0 – Reference Manual*. McGill University, Department of Psychology, and Pulp and Paper Research Institute of Canada, 1996.

5. Esbensen, K., Midtgaard, T., Schönkopf, S. *Multivariate Analysis – in Practice*. Camo AS, 1994.

6. Garthwaite, P. H. *An Interpretation of Partial Least Squares*. In *Journal of the American Statistical Association*, Vol. 89, No. 425, 1994.

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