Optimization of Flexo Printing Through Correct Use of Anilox Roll

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Introduction

- In the late 1800’s the first patented flexographic press came into existence and it was popularly known as “Bibby’s Folly”. It was basically named after Bibby, Baron & Sons of England, the inventor of this press.

- In 1952, Franklin Moss, the then president of Mosstype Corporation converted the name from aniline printing to flexography. Flexography got its name from the flexible rubber plates which are used to prepare the master relief image carrier for printing.

- In the flexible packaging industry, flexographic printing system is considered to be the best possible options. In recent years, the quality of reproduction of graphics has increased dramatically, with competitive cost of the final print product.

- Flexography is the most dynamic printing process of them all, and to be fair, it is also the oldest printing process that has re-invented itself over the years. Flexography is capable of process printing that Guttenberg could never have dreamed or imagined about.
Basic components of flexographic printing system

- Fountain roll.
- Ink metering or anilox.
- Plate cylinder.
- Impression cylinder.

Besides this, there are two traditional types ink feed systems used in flexography;
  - Two roll system.
  - Enclosed doctor blade system.
Merits of Flexography

- The flexographic press is relatively simple to operate and has a low cost.
- It is easily adapted to the use of water based inks which means a large reduction in VOC emission as compared to the heat set web or gravure printing processes.
- Flexographic presses are capable of producing high quality impressions on many different materials.
- Flexographic printing is one of the least expensive and most efficient processes used for decorative and packaging printing.
Flexography approaches

- Classic systems.
- Combined systems.
- Doctor blade systems.
Overview of flexo press
Anilox roll

- The flexo printing/coating process depends upon the precise controlled transfer of a liquid ink, varnish or coating.
- An anilox roll is simply a metering roll designed to consistently supply a uniform and measurable volume of ink onto the image carrier.
- Anilox roll is considered to be the heart of the flexographic press.
- Older methods of mechanically engraving cells into the surface of a roll have been replaced, to a large extent, by the precise computer controlled laser engravings of ceramic coated steel rolls. In this process, millions of minute holes (cells) are drilled into the ceramic surface of the roll.
- Ink receptivity and releasing capabilities of the anilox roll is of higher importance and ink transfer capabilities of the plate are determined by the surface technology of plate, surface tension of plate & ink and plate to ink compatibility.
The central part of the press is the anilox roller, the ink metering system unique to this process which allows the correct amount of ink to be carried to the printing plate. On the surface of the anilox roll are etched the cells which act as ink carriers. The number, shape and size of the cells (cell count) required on the surface depends on the:

- Ink used.
- Amount to be transferred.
- Material to be printed on.
- Image to be printed.
- Ink train configuration.

The latest anilox rolls are laser engraved, with cell counts currently up to 500 cells/cm, from a steel roller and coated in a fine ceramic. These laser engraved ceramic rolls, could last up to 10 years, depending on the wear they are exposed to from contact with the doctor blade. They provide an even, and consistent ink delivery in a controlled manner and provide narrow web flexo with a competitive edge in the leading packaging markets e.g. self adhesive labels for wines. Once the anilox is ‘charged’ with ink, the excess is wiped off with a flexible steel doctor blade.
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Besides the cell geometry, ink release capabilities of the cell is also affected by rheological properties of ink like; viscosity, surface tension, printing pressure between the plate cylinder and the impression cylinder, substrate properties, etc.
Anilox engraving angles

- Available engraving angles for anilox rolls are as follows: 90 degree angle, 45 degree angle, 30 degree angle and 60 degree angle.
- In 60 degree anilox angle, the hexagonal cell offers 15 percent more cells on the same area. Higher quantity of cells indicates a plus point concerning the ink transfer, as well as homogeneity.
Fiber optics laser engraving anilox rolls

- Diode pumped fiber optic lasers is used to engrave high line screens. Until recently, high line screen engraving could only be produced by using YAG (Yttrium Aluminum Garnet) lasers.
- It produces durable cell structure and excellent ink release characteristics.
- Since it has a low wavelength, it is able to engrave high line screens up to and above 2000 LPI.
- The cells are extremely smooth with a solid structure.
- Reports indicate an average of 10 to 15% better ink release than YAG engraving of the same line screen and volume.
- Higher line screen rolls increase ink control and reduce dot gain. These high line screens have done much to increase flexo’s competitiveness with offset and gravure.
- The fiber optic engravings make the cleaning and maintenance of these specialty roll much easier and quicker and also reduces plugging on press during long runs.
- It is very consistent and easy to maintain.
Ink Releasing Capabilities of Anilox Cell
CO2, YAG and Fiber optics laser engravings
Characteristics of anilox roll

- **Angle of the cells**: 60° hex pattern is the world standard for flexography printing for these reasons: the cells can be nested more tightly together, allowing for approximately 15% more cells in a given area.

- **Anilox roll volume** is the capacity of the engraved surface in a square inch, expressed in Billion Cubic Microns (BCM). Higher volume translates to higher solid ink density, more color or a heavier coating thickness. Lower volumes apply thinner ink films directly associated with higher print quality and process efficiency.

- **Line screen** (or number of cells per linear inch) is the third major component to understand when specifying an anilox roll. Line screen is chosen in direct correlation to anilox volume.
Terms related to anilox roll cell

- Average Cell Volume
- Cell Frequency in lpi or lpcm
- Cell Opening Diameter
- Cell Wall Width
- Cell Depth
- Cell Angles
Anilox sleeves

- Some of today's servo driven narrow web presses make use of anilox sleeves, which are much lighter than the standard solid anilox.
- The advantage is ease of handling and loading. On the narrow web side there is no difference in performance than with a conventional roll.
- Anilox sleeves initially were profiled in a scenario of short-run environments where anilox changes are very common and required, but have shown their usefulness regardless of the frequency of changeover.
- Sleeves are easier to store and inventory.
- The disadvantages of sleeves are their cost as well as the different care and handling that is required.
- Converters need to design special racks to store sleeves so that the chance of damage is minimized.
- In addition, sleeves cannot be cleaned in the same fashion as rolls, which may add more time and cost.
Anilox inventory

- Anilox rolls are one of the key elements in producing saleable product. Standardization of anilox roll inventory can help add profits to the bottom line.

- Today most converters typically need an 18-20-roll inventory to handle all their printing needs. Too often 30 plus rolls per press are seen while visiting a pressroom. Not only is this tying up money, it can be very confusing if proper documentation does not accompany each roll.

- One must be able to identify and inventory the minimum quantity of anilox rolls for all the printing needs, and then standardize this inventory across the pressroom for greater consistency and profitability.
Print quality enhancement

- Fiber optic laser engraved anilox roll.
- Ion-plasma treatment of anilox roll to decrease wetting when used with the working liquids and to increase the wear and corrosion resistance.
- Single reverse angle blade system for the smaller press and enclosed doctor blade system for the medium and large presses. As a general rule, a thinner blade edge allows for a cleaner wipe.
- Plastic doctor blades, as well as composite blade materials, are common place in today’s pressroom, primarily due to the safety advantages over metal blades. Plastic blades are more susceptible to pick-up of contaminants from the printing system.
- Chambered doctor blade, laser engraved ceramic anilox roll system proven by years of use in flexo are effective metering inks, UV and aqueous coating, as well as printers. Application is precise, uniform and consistent, scratches, voids, thickness variations, slinging, and ribbing are eliminated.
Right elastomeric compound roller covering with chemical resistivity, ink transfer qualities, hardness and abrasion resistance characteristics.

Digitally imaged rolls, sleeves and plates enhances print quality, reduces set-up time and make ready times and increase press speed.

Heating, cooling, conditioning control systems for the modern flexo presses with high speeds, integrated automatic controls, drives and functions to take care of the temperature problems for inks and coatings, thereby reducing possible wastage and enhancing print quality.
Recent developments

- **Digital imaging** of plates allows very good quality half tone work to be carried out.
- **Sleeve technology**, where the entire printing plate is produced and used a removable sleeve on the printing cylinder, permits faster press speeds and better registration.
- **Water-based inks** can be used which are more environmentally friendly. Water based inks are similar to solvent based inks, requiring the evaporation of the water to produce the final printed result. This requires more energy, via heat, to be applied in drying. The use of water-based inks is actively encouraged as a more environmentally friendly printing method. Water based inks are becoming dominant in corrugated and paper industry sectors, where the water is absorbed into the substrate, reducing the energy required to dry the ink fully.
- **UV curing inks** give high resolution, strong colours and ease of handling which makes them ideal for carton board and narrow web label applications. These inks require finer, lower volume anilox rolls where the applied ink volume is reduced.
- **Gearless presses** give infinite adjustments of repeat lengths.
- **Microdot mounting systems** give excellent registration.
Conclusion

- The future of packaging is flexo, and the future of flexo is digital.
- Application of digital technology throughout the packaging workflow offers benefits from concept to consumer with speed, color management, consistency, higher image quality graphics and reduced wastage.
- Today, flexography has carved out its own turf in the package and label printing industries cost effective, high quality inline printing and converting for everything from short-runs to high speed long runs on paper, film or board.
- It is perhaps the most versatile printing process in the world and the process is perfectly aligned with the future of a dynamic packaging industry.
- As the flexography process becomes more and more automated, it becomes more and more a manufacturing process capable of zero defect products for less cost. It isn’t what the future holds for flexography, it’s what flexography holds for the future.