

Anilox Guide

for Offset Coating Applications



Harris & Bruno
INTERNATIONAL

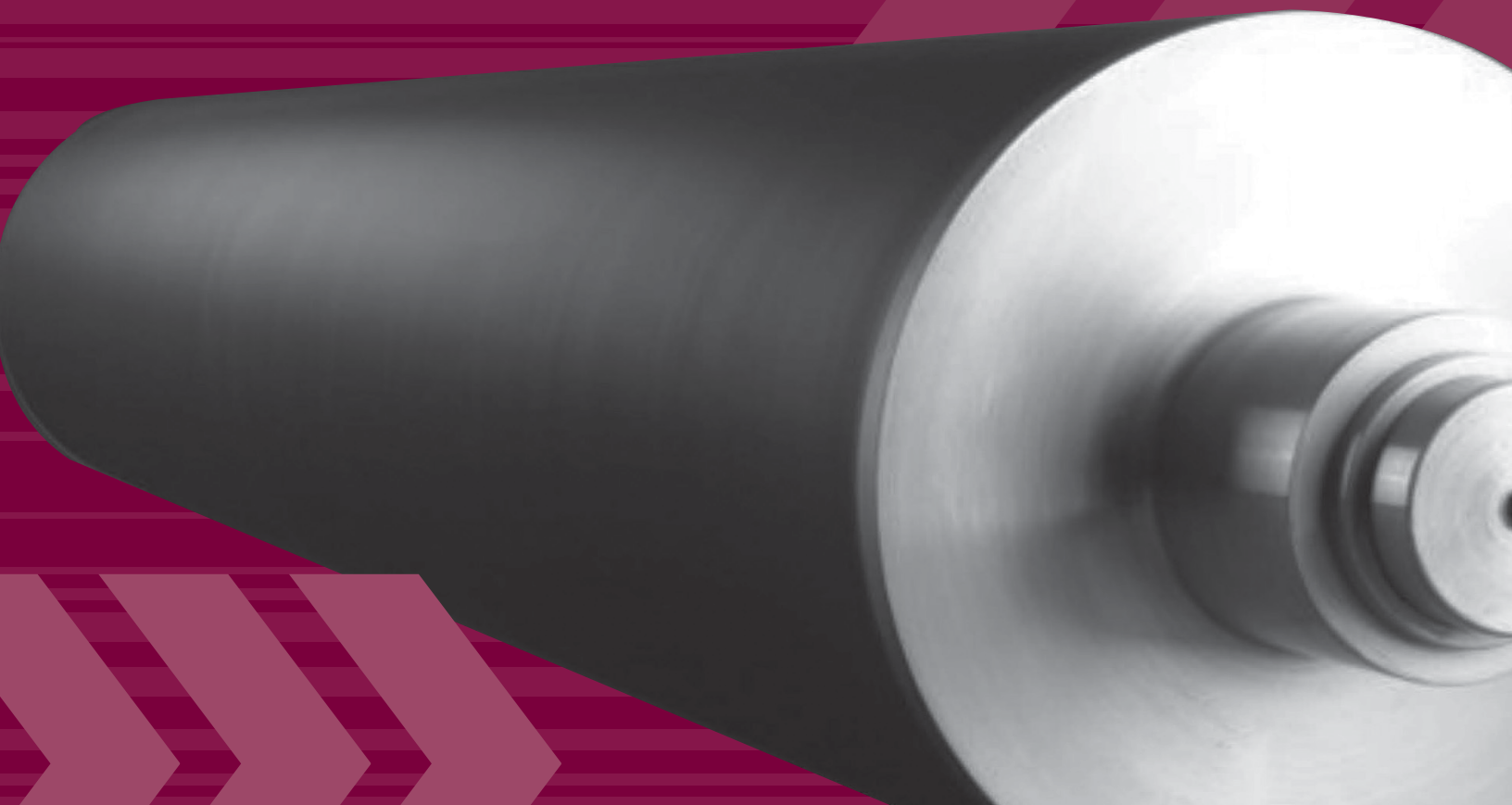


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H&B Anilox Rolls

A comprehensive guide to their construction, technology, and specifications

Celebrating over 60 years in business, Harris & Bruno International is a leading supplier of chamber/anilox systems for inking and coating equipment throughout the world.

Similarly, we are the preferred supplier of chamber/anilox systems to the majority of the worldwide sheet-fed press OEM's. These alliances grant us with an inclusive network of press information and anilox roll drawings, allowing us to provide you with the right roll every time.

Technical support is our top priority. With offices in America, Europe and Asia and with expert engineers on site with know-how in all your printing and anilox needs, we provide superior global sales, service and support.

Our value is in our industry expertise and extending the benefits of our OEM relationships which include the following:

- High levels of roll inventory
- Comprehensive network of press information
- Quick turn-around time as we stock common cores
- Ability to guarantee roll specifications
- Cleaning service for plugged rolls
- Efficient logistics, transport and delivery
- Local representation

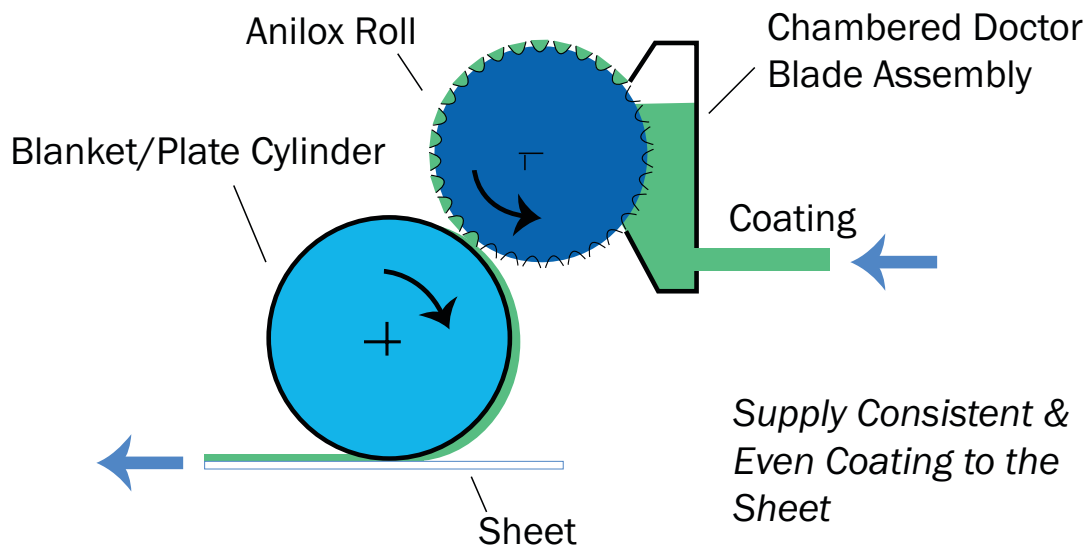
These areas of expertise translate into value for our customers!

What is an Anilox Roll?

In coating, an anilox roll is used to provide measured amounts of coating to a coating blanket and can be thought of as a precise metering roll.

An anilox roll is a hard cylinder, usually constructed of steel, carbon fiber, or an aluminum core with steel journals. This core is then plasma coated with a hard ceramic, usually chromium oxide. A high powered laser is then used to vaporize the ceramic and create tiny “cup shaped” cells in the surface of the ceramic. It is these cells that will contain and deliver the proper amount of coating to the coating blanket. A chambered doctor blade system supplies and meters coating to the anilox roll. The excess coating is metered or “doctored” from the surface of the roll leaving coating only in the cells of the anilox roll. The coating in the cells is then deposited onto the surface of the coating blanket.

Anilox Roll & Chambered Doctor Blade System

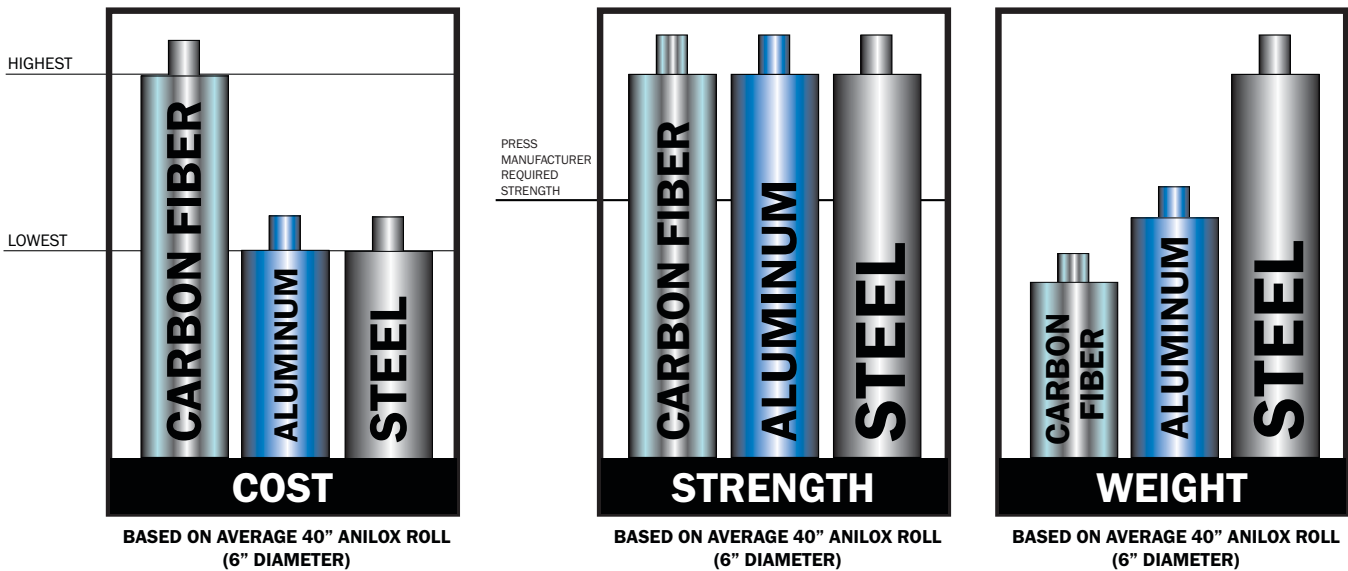


Anilox rolls are often specified by their “line screen”, or, the number of cells per linear inch and the volume of these cells. Anilox rolls are designed to be removed from the coater and exchanged with rolls of varying line screen and volumes depending on the coating requirements.

Since most coaters do not have an overhead hoist, it is preferable to manufacture the roll core from lighter weight materials such as carbon fiber or aluminum for ease of handling and to minimize the chance of damage when changing rolls out. Although the ceramic surface is extremely durable in terms of wear, it is very brittle. Extreme caution must be taken when handling anilox rolls as a single bump against a hard surface or sharp corner can destroy the delicate cell structure on the surface and render a roller completely useless.

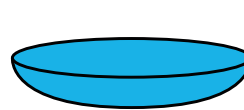
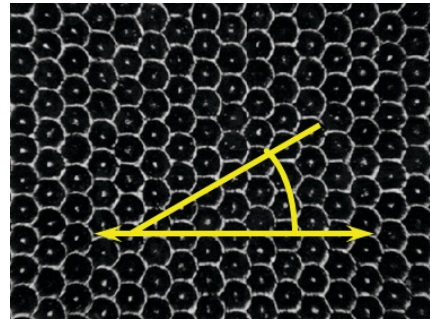
Core Construction

The Harris & Bruno facility utilizes the latest technology in machinery and test equipment. In-house machining of cores allows for better process control and improved lead times.

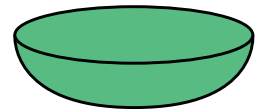


Anilox Engraving Terminology

- Screen count is the number of cells per linear inch (lpi) or l/cm
- Screen count is measured at the angle of the engraving
- Screen counts from 50 lpi to 1200 lpi are available
- Anilox cells can have varying volumes from roll to roll which are measured as billion cubic microns (BCM)



2.5 BCM



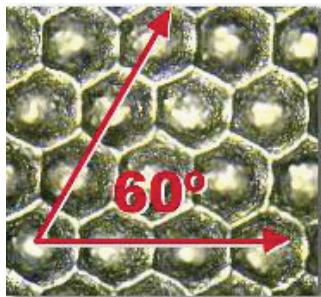
5.0 BCM

Surface Geometry

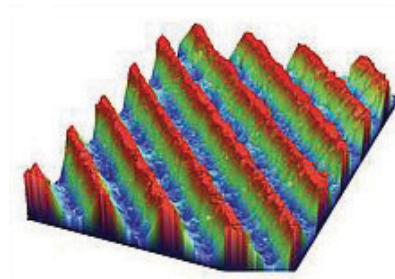
Anilox cell angles are predominately 60° hex pattern and the tri-helical patterns.

60° hex patterns are recommended for most coating applications for the following reasons:

60 Hex



Tri-Helical



- Cells can be positioned tightly together, allowing for up to 15% more cells in a given area.
- A more uniform cell wall surface is created allowing for better doctor blade performance and higher printing/coating quality.
- The straight side of a cell wall is not positioned horizontal thereby avoiding channeling.
- The hex pattern is easier to reproduce and therefore customers will notice consistency from roll to roll.
- Tri-helical engravings are a continuous “V” shaped cell that spirals around the axis of the roll, similar to a screw thread. These engravings are typically at a 45 or 60 degree angle. Unlike hex shaped cells, these engravings do not have individual cup shaped cells. This open cell configuration is especially effective with smooth release of more viscous materials such as UV coatings and adhesives.

Anilox Line Screen

Line screen indicates the number of cells per linear inch or linear cm, on an anilox roll, and is a major component when specifying an anilox roll. Typically line screens increase as cell volumes decrease.

Calculating the Number of Cells per Square Inch

There are two calculations for determining the number of cells per square inch of an anilox roll. One calculation is specifically for 45° cell patterns and the other accounts for both, 60° or 30° anilox configurations.

45° Cell Patterns:

Line Screen X Line Screen = # of Cells per Square Inch

Example: For a 500 Line Screen, 45° anilox roll: 500 line screen X 500 line screen = 250,000 cells per sq. inch

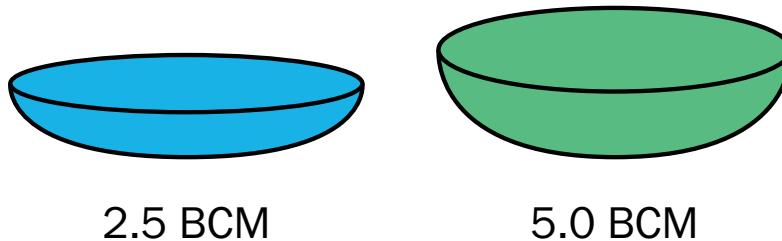
60° and 30° Cell Patterns:

(Line Screen X Line Screen) X 1.15 = # of Cells per Square Inch

Example: For a 500 Line Screen 60° or 30° anilox roll: (500 line screen X 500 line screen) X 1.15 = 287,500 cells per sq. inch

Anilox Cell Volume

- Cell volume is measured in Billion Cubic Microns (BCM) per square inch
- Cell volume determines coat weight



Cell Volume

The amount of coating that is transferred from a cell depends upon the carrying capacity of the cell, or the cell's volume. Volume must be accurately measured and maintained. Anilox volumes are measured in BCMs (Billions of Cubic Microns) per square inch. For example, a typical engraving would be described as 200lpi /9.0bcm 60 degree hex. It is imperative that the volumes be checked on a periodic basis through Harris & Bruno's ASAP Diagnostic program.

Thinner films of coating are easier to manage, lay down smoother, are easier to dry, and minimize overall coating usage. The goal is to lay down the thinnest film of coating that will give the required physical and optical results.

Below is a guide with approximate line screens and volumes for the most common coating applications.

Application	Appropriate Anilox Line Screen (Lines Per Inch)	Appropriate Anilox Volume / Screen Type
Most Aqueous coating applications using paper	200-220 LPI	8-8.5 BCM / 60° Hex
Soft Touch Aqueous Coating	180-200 LPI	10-10.5 BCM / 60° Hex
Most UV application	160-200 LPI	10-14 BCM / 60° Hex or Tri

H&B has the ability to provide consulting services for specialty coatings such as, metallics, pearls, grits, blister, raised UV, etc.

Measuring Anilox Volumes

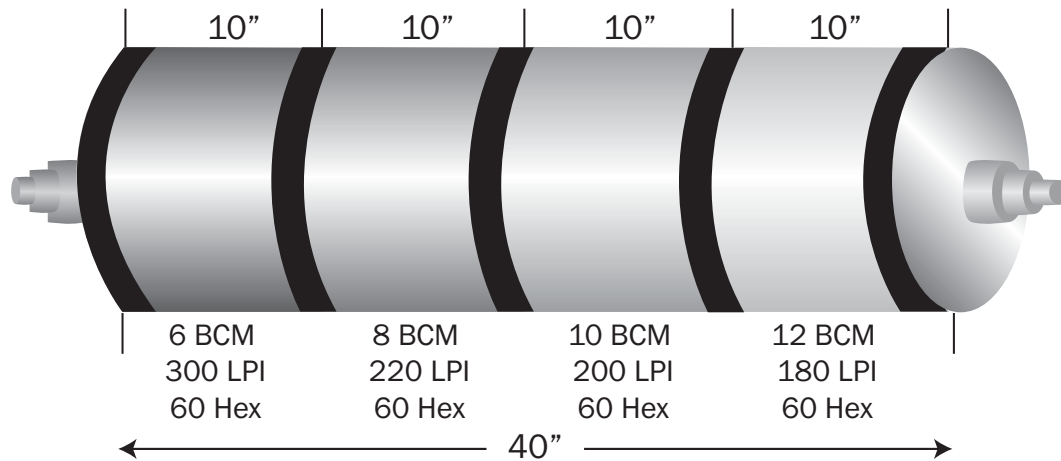
Anilox volumes are measured in BCMs (Billions of Cubic Microns). Keep in mind that we are dealing with very small measurements and that every micron is critical. How big is a micron? A human hair is approximately 70 microns in diameter.

At H&B we measure our rolls using white light interferometry. This technology allows us to gather the surface features of the cells while moving down into the cells in a vertical path. This information is fed back to computer software whereby we are able to generate a surface map and the internal shape of the cells.

This technology can be employed using our ASAP diagnostic program whereby we can take an impression of your rolls at your facility and then evaluate them in our lab using our white light interferometry system.

Banded Test Rolls

Typical Banded Roll



A banded roll contains actual bands of different line screen and volume combinations. A banded roll test helps determine the correct line screen and volume combination for evaluating the desired coat weight. The same printed image is repeated across the sheet to correlate with the bands in the anilox roll.

With coating application and technical expertise on staff, H&B provides customers with accurate engraving specifications for their applications. We also provide in plant visits, working directly with the customer to test and run various coatings and applications, offering the technical expertise you require to keep your operations running efficiently and with superior quality. Our experts will provide recommendations from the coating to the delivery of that coating and which roll is best suited for your end result. As the leading supplier of chamber/anilox systems for inking and coating equipment, H&B supplies the hardware and the support services customers require in today's marketplace.

We are so sure of our service, that all rolls we specify will be guaranteed to meet the customer specifications or the roll will be re-engraved.

Determining Actual Coat Weight

The most accurate way to determine precisely how much coating is being deposited onto the sheet is to do an actual coat weight test. This procedure covers the steps necessary to perform an accurate coating film weight test on a sheetfed press. A wet film weight of 0.8-1.2 lbs per thousand square feet of stock is recommended for most aqueous coatings.

Materials:

- Blank stock
- Aluminum foil
- Scotch tape
- Razor blade
- Ruler
- Gram scale with accuracy to at least 3 decimal places
- Calculator

Steps

1. Obtain a piece of aluminum foil that is at least 12" x 16". Fold the piece of aluminum foil in half.
2. On a blank sheet of stock that is being used for the printed work, securely fasten the folded aluminum foil to the stock using the scotch tape. Be sure the foil and the tape are as flat and smooth as possible. It is also important to be sure the foil is fastened to an area of the stock that will be completely coated.
3. Multiple pieces of foil may be fastened to the same sheet of stock. If the size of the stock allows, repeat steps 1 & 2, each time placing the foil in a different area to be measured. Example: a) gripper operator side b) operator side tail c) gripper guide side d) guide side tail. Measuring different areas tests for coating uniformity across the sheet.
4. Place the stock with the foil in the feeder about 25-30 sheets down in the pile.

5. Lift the impression off all of the inking units.
6. Start the press and run the stock through until the foiled sheet appears in the delivery.
7. Remove the foiled sheet.
8. Using the ruler and razor blade cut a 4" x 6" rectangle out of the foil. Be sure to cut through both layers of foil. Separate the layers and keep a record of which sheet contains the coating. The top layer is coated and the bottom layer is uncoated.
9. Place the uncoated layer on the gram scale and zero the weight of the foil. (Be sure the gram scale is accurate to at least 3 decimal places.)
10. Remove the uncoated layer and place the coated layer onto the scale. Record the weight of the coated foil. This weight is the net weight of the coating in grams.

Wet Pounds per Thousand Square Feet

1. Divide the net weight of the coating by the square inches of the foil to obtain grams per square inch.

Example: A 4x6" piece of foil is 24 square inches.

The net coating wet is .025 grams.

.025 divided by 24 = .00104167 grams per square inch.

2. Multiply grams per square inch by 144 to obtain the gram weight per square foot.
3. Divide grams per square foot by 454 to obtain pounds per square foot.

Example: .150 divided by 454 = .0003304 pounds per square foot.

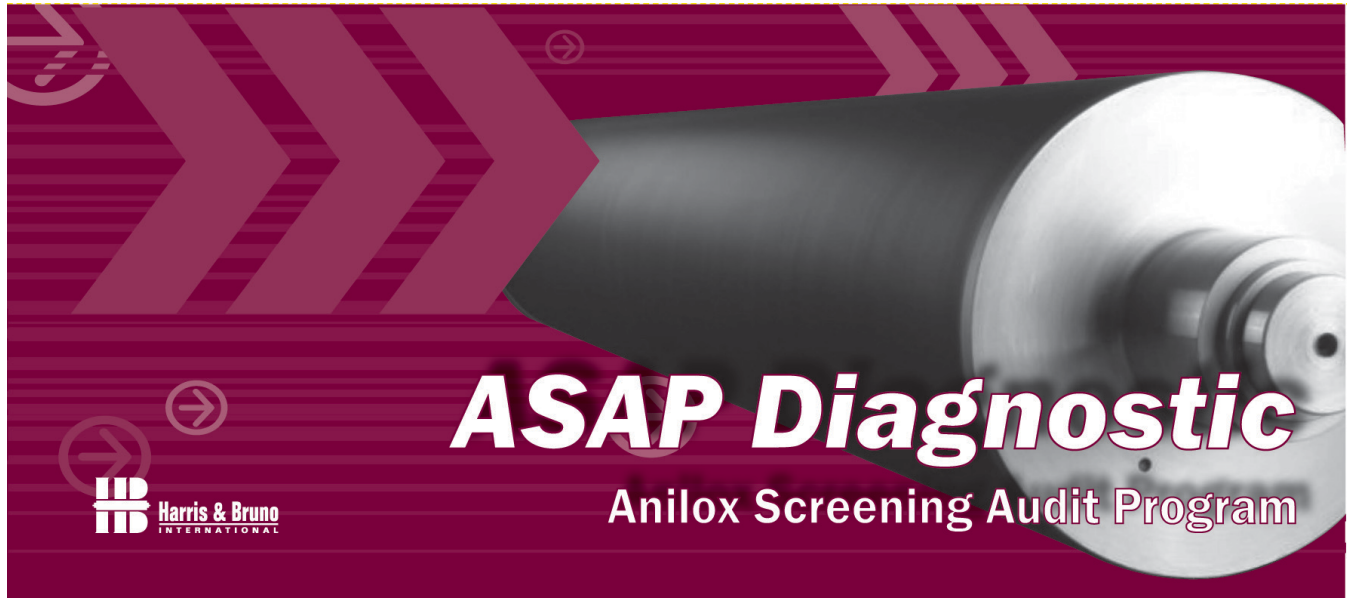
4. Multiply pounds per square foot by 1 000 to obtain dry pounds per 1 000 square feet.

Example: .0003304 x 1000 = .3304 dry pounds per 1000 square feet.

5. Multiply dry pounds per 1000 square feet by 2.5 to obtain wet pounds per 1000 square feet. The factor of 2.5 is based on aqueous coating solids of 40%.

Example: .3304 x 2.5 = .826 wet pounds per 1000 square feet.

ASAP Diagnostic (Anilox Screening Audit Program)



Harris & Bruno International offers an anilox inspection program called ASAP Diagnostic (Anilox Screening Audit Program). ASAP is a simple, self test kit that's easily performed while the roll is in or out of the press.

The test is then mailed to Harris & Bruno International for a complete, free diagnostic roll report. An in-depth analysis on the overall condition and cleanliness of the roll with recommendations will be provided to the customer. Recommendations may include cell cleaning, laser re-engraving and/or a replacement roll.

Request an ASAP Diagnostic kit from your local Harris & Bruno service or sales representative, or call corporate headquarters at (916) 781-7676 and a kit will be promptly mailed to you. Be sure to request multiple kits if you'd like to test more than one roll.

The following page contains a sample of the free ASAP Diagnostic report that will be provided.

ASAP Diagnostic Report

(Anilox Screening Audit Program)



DATE _____
 CUSTOMER _____
 CITY, STATE _____

ROLL INFORMATION		ROLL ANALYSIS (in averages)	
Sales Rep & Contact Info	_____	Cell Volume	_____
Roll Serial #	_____	Cell Depth	_____
Original Roll Manufacturer	_____	Cell Wall	_____
Orig. Purchased/Installed Date (if known)	_____	Screen Angle	_____
Original Cell Volume	_____	Screen Count	_____
Press Manufacturer	_____	Engraving Type	_____
Press Model & Year	_____	% of Volume Change	_____

SUMMARY OF OBSERVATIONS

Plugging (Light, moderate, heavy) _____

Wear (Light, moderate, heavy) _____

Overall Cell Condition _____

RECOMMENDATIONS & CUSTOMER ROLL IMAGES	CUSTOMER'S ANILOX ROLL
Continue Use As Is _____	
Clean & Continue Use _____	
Re-engrave _____	
Other _____	
Inspected By: _____ Date: _____	
Approved By: _____ Date: _____	

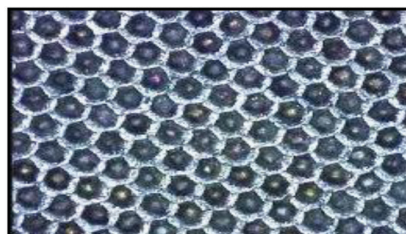
ASAP Diagnostic Report

(Anilox Screening Audit Program)



CHARACTERISTICS OF A WORN ROLL

- Streaking patterns on the substrate
- Increased foaming due to air introduction into chamber
- Reduced coat weights or ink density
- Cell walls chipped



CHARACTERISTICS OF A PLUGGED ROLL

- Inconsistent coating or poor quality
- Gaps in coverage and reduced ink density
- Ink back trapping onto the coating blanket
- Dried coating or ink visible in cells



Anilox Roll Cleaning Procedures

Anilox rolls are high quality precision instruments that must be transported, handled, used, cleaned and maintained with extreme care. It's equally critical that your anilox roll be cleaned on a regular basis to keep your print and coating quality at its best. Please follow our recommended care guidelines below and review the summary of services we offer to help care and maintain your roll:

Self Cleaning - How to Clean Your Roll

Materials Required:

- Harris & Bruno's "Cell Solution"
- Anilox roll cleaning brush with stainless steel bristles (available from Harris & Bruno)
- Chemical resistant gloves to protect your hands from injury and chemicals
- Safety glasses
- Clean facility water (water based coating only)
- Lint-free cloth

Warning: Do not use a highly acidic or caustic cleaner on the anilox roll. An acceptable pH range for cleaning and using anilox rolls is 5.5 to 10.5. Be safe and use the Harris & Bruno Cell Solution.

Harris and Bruno recommends performing the following maintenance regularly (weekly or as needed) in order to keep the anilox roll clean:

1. Start at either end of the roll by applying the Harris & Bruno Cell Solution onto the anilox roll surface. (A cell solution sample has been included in your anilox roll crate)
2. Using the anilox roll cleaning brush, provided by Harris & Bruno, begin lightly scrubbing in a circular motion while applying light pressure and rotating the roll.
3. Repeat the procedure until the entire roll has been completely scrubbed.

4. Gently wipe the anilox roll thoroughly with water or 99% isopropyl alcohol. Repeat procedure on any unclean area.
5. Cleanliness of the roll can be verified by using Harris & Bruno's ASAP Diagnostic program as described in this guide.
6. For difficult situations where regular cleaning is not producing the necessary results, please see below and contact Harris & Bruno to learn more about our professional roll cleaning service.

Professional Roll Cleaning Service

If your roll becomes plugged and you can't clean it yourself, send it to us for professional cleaning. If we find the roll damaged or plugged beyond what a professional cleaning can correct, we can easily re-engrave the roll internally and will credit 50% of the cleaning cost towards a re-engrave. In most cases, worn or plugged rolls can be stripped and re-engraved using the original core material, saving the customer the cost of buying a new roll.

Rolls will be cleaned using an enclosed anilox roll cleaning system which uses specially designed plastic pellets to gently remove dried inks and coatings. Fine polymer beads are applied under air pressure to remove the dried matter from the anilox engraving, restoring cells to their original volume. This media is non-abrasive and will not damage the delicate cell walls. This cleaning process thoroughly cleans rolls, repeatedly, without damage to the cells.

ASAP Diagnostic (Anilox Screening and Audit Program)

If you are unsure if your roll is plugged or not and want to test your roll on-site or in the press, simply call and we will send you our free ASAP Diagnostic kit. Once the test has been performed, mail the test back to Harris & Bruno for a complete, free diagnostic roll report. An in-depth analysis on the overall condition and cleanliness of the roll with recommendations will be provided. Recommendations may include laser re-engraving, professional cell cleaning and/or a replacement roll. For more information, please review the ASAP Diagnostic program highlighted in this guide, or call Harris & Bruno International at 916-781-7676.

Warranty Information

All Harris & Bruno products come standard with a 100% satisfaction guarantee. If you are not completely satisfied with this product, notify us in writing within 90 days after receipt, and you may either work together with our staff to meet your expectations or return the equipment for a complete refund.

What is Covered?

- The anilox roll has a warranty of one year from date of receipt.
- The anilox roll cell structure is guaranteed to be free of defects and to be within 5% of the ordered volume.
- All journals and dimensional tolerances are to be within the original press OEM specifications.

What is Not Covered?

- The surface of the anilox roll is a very hard and brittle coating of chromium oxide. Any chipping, dents or surface imperfections as a result of poor handling are not covered. Make sure to use the H&B supplied roll cover when taking the anilox roll in and out of your press.
- The chromium oxide bond properties may be compromised if a pH cleaner over 10.5 is used. Please use the recommended H&B Cell Solution cleaner, which is in the proper pH range.

For more information regarding Harris & Bruno International products or services, please visit our website at www.harris-bruno.com or call our offices at (916) 781-7676.



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