How long should an anilox . . . . . roll?

By: David J. Lanska MBA

One of the most frequently asked questions in flexography pertains to the durability of the anilox roll. The anilox is one of the most talked about topics of technical articles in all of flexography. Articles have been written about how they are manufactured, engraving patterns, benefits of ceramic anilox rolls, types of laser processes, available cleaning techniques, proper care, evaluating the cell characteristics, determining the “correct” cell characteristics, measuring cell volume, proper surface finish, attending to physical issues such as journal wear, TIR (total indicator runout or concentricity), depth-to-opening ratios, auditing roll condition, and many others.

Even articles written about other press components invariably touch on their interaction with the anilox roll. Based on the shear volume of information about anilox rolls, it seems strange to be asked such a seemingly basic question as ‘how long should an anilox last?”. Perhaps the reason the question is asked is that it is not such a simple, straight-forward question. Everyone wants a straight answer, not realizing it is actually a trick question.

A lot of the misconceptions about anilox durability derive from the “simple” statement made thousands of times by anilox manufacturers and their representatives: “Ceramic is harder than chrome”. That is a fact. Chrome oxide ceramic has a hardness of about 1200 Vickers compared with chrome at about 900. Chrome oxide is typically applied directly to the steel base core or over a corrosion resistant alloy. In either case, the foundation is stronger, tougher, and less malleable than the copper underneath the chrome. In most cases, the chrome roll will show wear long before a comparable linecount ceramic roll.

So why is there a question? Put bluntly, we are comparing apples to orangutans. When we were comparing chrome to ceramic, most printers were still running rubber nip rolls instead of doctor blades. We were happy running a couple hundred feet a minute with a rubber stamp print process, producing rubber stamp quality. We were doing a lot of solids, a little linework, and very crude process with 85 line plates and an anilox inventory that topped out somewhere between 300 and 600 LPI.

We are not looking at how ceramic rolls compare to chrome anymore. We are asking how long today’s ceramic rolls will last under today’s press conditions. We are running 300, 400, 500 fpm or more on water based ink and well over 1000 fpm on solvent. Our linework has turned into barcodes that have to read properly day in and day out. Our solids have become screens and vignettes. Our process printing … Can we begin to grasp how far we have come with our process printing ? We have to think about what line screen plates are the norm today ?

133 or is it 150 ? How many printers routinely go to 175, 200 or even beyond that ? How many run digital plates with smaller than 1% highlight dots? When we are inking those microscopic highlights, are we still running anilox rolls between 300 and 600 LPI ? Many company's process rolls start today at 800 LPI and go up from there.

So far, I haven't even mentioned the changes in flexographic inks. Ink manufacturers are under constant pressure from printers to develop faster drying, higher pigment load inks that provide vastly improved performance on the label or package. Enter catalytic inks, which form a chemical reaction and cross-link when the components combine. These inks are impervious to UV light and impenetrable to rub. Faster drying than a speeding locomotive, and able to leap tall buildings at a single bound, these "Super Inks" create "Super Problems" for the anilox rolls that apply them.

A great many factors play into the longevity of the anilox roll. Inks that dry quicker on the web also dry quicker on the anilox roll. Inks that are more durable on the finished product are more tenacious when dried in the wrong spot: on the anilox roll. Doctor blades, which provide vastly improved ink shear from the roll surface, generate a lot of friction against the anilox roll, even when properly adjusted. In situations where excessive blade pressure is applied the friction is even greater, quickly wearing the blades and resulting in wear or damage (or both) to the anilox roll. (This is magnified as press speeds increase).

Of course, all of the steel shavings that wear off the blade are going somewhere. Here is a pop quiz. Where are the shavings going ? A) To the land of Oz B) To the FFTA Forum or C) Into the ink. I'll give you a hint: Dorothy didn't take them and they didn't register for the Forum.

Metal shavings and other hard particles (contaminants) that find their way into the ink can become wedged under the doctor blade and dragged along the roll surface causing the cell walls to wear or break down in rotational bands around the roll. These score lines are a form of cell damage that prematurely reduces the anilox roll's life.

Higher pigment load inks mean more abrasive particles in the ink. Many pigment materials are crushed rock. White ink routinely has crushed titanium in it. I said before that ceramic is hard. Did I mention it is also brittle? I would venture to guess that virtually every experienced printer has run across a roll where the edge of the ceramic had chipped when it got banged going in or out of the press or cleaning system. How many people stop to think that ceramic is also brittle on a microscopic level.? Cell walls that are only a few microns thick can break down very easily if they are subject to an impact with a hard object. Well ladies and gentlemen, titanium pigment particles are hard objects. In fact, any clump of dried ink or chunk of ceramic (chipped from the edge of the roll) that falls into the ink fountain is a potential anilox killer.

Another major determining factor in roll life is handling; both the frequency and the care exercised. Rolls that are taken in and out of the press on a regular basis are much more likely to receive incidental damage: dents, dings, scrapes, or chips. This also holds true for rolls placed in cleaning equipment. Even if the cells are not damaged from an impact, metal debris scraped into the cells will rarely come out in the cleaning cycle. Instead, it imbeds into the crevices of the roll surface, preventing the cells from carrying and depositing the proper amount of ink. In other words, if metal fills the cells ink can not. The result will be a light spot or streak in the print. Even though the cells themselves may not be damaged, often, the only cure is to have the roll resurfaced.

Frequent change-overs present another hazard to roll longevity. If the rolls are not cleaned promptly and thoroughly, cell plugging will occur. The longer the ink is allowed to set, the more tenacious it tends to be. If the ink dries streaky because the roll was not properly rinsed off, the variations in cell plugging may not be entirely removed by mechanical cleaning methods. Partial plugging of some cells will result in the transfer of less ink from those cells, in effect transferring the streaky pattern from the roll to the print.

The cleaning method used and whether or not it is used properly will have a significant bearing on roll life. Almost every cleaning system ever offered for anilox rolls has been accompanied by some statement that it is safe for the rolls. While this may be true if the system is installed, operated and maintained properly, we have found damage to occur from virtually every system when used improperly.

With any system geared around agitating liquid cleaning chemistry, the proper match of cleaning chemistry to the ink being removed is paramount. Of course, if the cleaning chemistry is so entirely polluted with ink components that it resembles crude oil, it will not clean properly. The overwhelming urge is then to repeat cycles or lengthen cycle time. The constant bombardment of cavitation activity will then shatter the wall structure. Failing to keep the roll rotating will often result in patches of localized wall damage from concentrations of caviation action hammering those areas of the roll with greater intensity than surrounding areas.

With media blast, it is again critical that the roll be kept rotating and the blast not be concentrated on a given location for any length of time. Improper nozzle to part distance, misalignment of the nozzle, excessive air pressure, excessive cycle time or frequency again combine to prematurely shorten roll life.

You might be thinking, “anilox rolls didn’t used to damage so easily”. Maybe not, but chances are good that your current roll inventory has several high (550-800 LPI) or very high (900-1500) linecount rolls. Contrast that with your inventory of 5 or 10 years ago where you may have had mostly 210 up to 500 LPI rolls and just a hand full of rolls above that. Chances are good that the walls that separated the cells back then were almost as wide as the cell openings are today. Walls on engravings over 600 LPI are typically 5 microns thick or less – A fraction of the thickness of a human hair ! It is no wonder that they can be damaged, even when made out of ceramic, (a material that is very hard and wear resistant).

Some may contend that they do not use mechanical methods so their cleaning approach should not affect the life of the roll. How long would you expect your car finish to last if you washed it with hydrochloric or hydrofluoric acid, or severely corrosive caustic chemicals ? Any tiny gaps in the paint (from a stone or scratch) would allow these harsh chemistries to attack and corrode the sheet metal. With an anilox roll, the plasma spray ceramic coating process results in microscopic gaps known as porosity. These gaps can provide a clear path to the base metal, allowing oxidation (rust) to occur. The oxidation undermines the mechanical bonds that bind the ceramic to the roll surface. At the same time, the oxidation pushes on the ceramic, forcing it to lift. Even if the chemicals can not get through the ceramic, they can still attach at the ceramic, base core interface along the edges of the roll face. That is why anilox manufacturers strongly discourage the use of harsh chemicals for cleaning anilox rolls.

Do roll storage practices affect roll life ? Absolutely ! Rolls that are left uncovered can get ink and cleaning chemicals spattered on them. They can get banged or bumped. Objects can get dropped onto them. A storage rack could get accidentally toppled by a forklift. (It has happened). Any time operators have to strain or stoop to reach the rolls, there is potential for one to get dropped. If something is piled up in front of the storage racks or carts, (ink bottles and rolls of label stock or finished labels) the operator could trip and damage the roll (and cause injury to him or herself). Clearly, it is best to store rolls at a convenient height, in an easily accessible location. They should be clean and dry, and covered to protect them and keep them clean.

If a roll does become damaged or worn, does that necessarily mean it's useful life is over ? Not necessarily. Some damage occurs outside of the printing area. Depending on the type of printing being done at a particular print station, some damage will not show up in the print. (i.e. Printing linework, applying adhesive, laying down a white background layer). Some printers add greatly to the life of their rolls by using worn or slightly damaged rolls for these types of less critical tasks.

What should be crystal clear by now is that the actual manufacture of the roll plays only a small part in determining its useful life. How it is used, handled, maintained, and stored play an equally important role. In many cases, ceramic anilox rolls last 10 years or longer. On the other hand, if the tape measurer drops off your receiving clerk's belt and strikes the roll surface, the roll can be toast before it ever comes out of the shipping crate. Anilox manufacturers strive to provide rolls with precision an consistency that is nothing short of miraculous. So the question comes down to "how long should it last?" The answer I'm afraid is "it is up to you".