PRAXAIR
SURFACE TECHNOLOGIES

Ceramic Anilox Roll Cleaning Systems

If the cells of Praxair Surface Technologies' laser engraved ceramic anilox rolls become clogged with dirt, dried ink, or coatings, print quality is affected. In normal use, laser engraved anilox rolls must be cleaned as soon as possible after the completion of a press run to remove residual ink/coatings. All too often, a delay or interruption in the cleaning process may cause an anilox roll to become ineffective due to build-up of dried deposits in the cells. The build-up reduces the roll's ability to carry the proper amount of ink/coating. When this occurs, a method of effectively removing unwanted deposits and restoring cell volume is needed.

This Hard Facts looks at some of the cleaning systems that are used to restore the ink-carrying capacity of a laser engraved ceramic anilox roll, by removing deposits that are clogging/plugging the roll's cell structure.

Cleaning Methods

Any method used to clean the engraved coating must penetrate the depth of the microscopic cells in the hard ceramic coating that gives the roll its long life. Solids from ink pigments, varnish, etc. deposited in the bottom of each cell must be dislodged and carried away. A satisfactory cleaning method must do this without damaging the cell walls, so a balance between cleaning aggressively to remove deposits quickly and protecting the integrity of the roll's surface must be achieved.

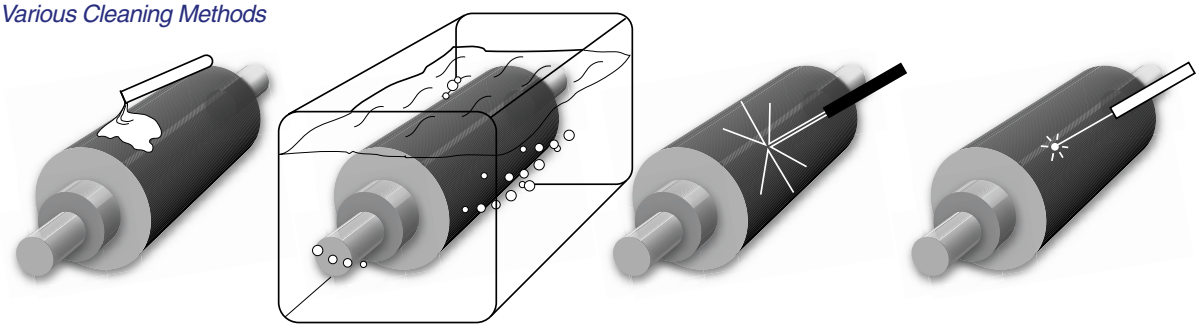
Chemical Wash - Chemical wash anilox roll cleaning systems dissolve ink build-up in anilox cells using a caustic cleaning fluid wash followed by a highpressure water spray. These processes clean by softening the ink/varnish deposits chemically, then by dislodging them with the force of the rinse.

They do not use abrasives, and they are advertised as preserving the integrity of the roll's surface. Because these systems use fluids that are not size-limited in their ability to penetrate the small cells of high screen count anilox rolls, they can be effective on screen counts of 1000 lines per inch and above with these systems, the roll is placed in a closed tank where it is rotated and flooded with a heated cleaning fluid that is applied, recirculated, and filtered. When this wash cycle is completed, a high-pressure water spray travels the length of the rotating roll and removes the residue from the cleaning solution and the dissolved inks. The cleaning process is completed by drying with compressed air.

Because there is a potential disposal problem with the effluent from this process, it is important that these systems include provisions for separating the effluent from the removed deposits and cleaning solution into flushable wastewater, and solid sludge for appropriate disposal.

The systems surveyed were completely automatic, and available in sizes designed for narrow web with capacities up to six rolls, and for wide web with capacities of one or two rolls. A YAG engraved test roll with a 1200 line screen and Rainbow™ treatment was contaminated with several types of ink over an extended period and successfully cleaned by this process with no damage to the engraving, or the Rainbow treatment.

Various Cleaning Methods



Chemical Wash *Ultrasonic* *Media Blast* *Laser*

Media Blast - Media blast systems use air pressure to propel material against the roll surface to dislodge deposits in anilox cells. The media used must be softer than the roll coating so that it does not damage the engraved cells, and it must be propelled by only enough air pressure to remove deposits and not damage the coating. The nozzle expelling the media must be carefully positioned above the engraved surface and moved constantly over the roll surface.

The media itself must consist of particles small enough to fit into anilox cells. Average cell openings range from approximately .005" for 200 line screens to .0008" for 1200 line screens.

Key elements for successful operation of any media blast system include:

- Nozzle standoff distance must remain constant for even cleaning effect over the entire engraved surface.
- Nozzle angle must be 90 degrees to the roll surface. This will direct its media into the cells and not against the sides of the cells where it can damage the cell walls.
- Dwell time must be rigidly controlled by nozzle travel and roll rotation speeds. Careful control of nozzle movement is necessary to ensure the process does not linger in one area long enough to cause engraving damage.
- Air pressure must be only as intense as required for successful cleaning. Excessive pressure may cause the media stream to be too aggressive and attack the engraved surface.

Over time, repeated exposure to the media blasting action may cause cell walls to show signs of deterioration. These are not cleaning methods to be used daily on the same roll surface, but they can be used in a regular maintenance program as a supplement to routine press-side cleaning, or to restore plugged engraving to its original cell volume.

Baking Soda Systems use a specially formulated baking soda powder as an abrasive media. This material is gentle on the roll surface and is available in particle sizes that reach into the anilox cells. It is a non-hazardous, non-toxic media and can be a quick and effective roll cleaner. The media is typically propelled by air pressures less than 40 psi, a level that is also friendly to the engraved surface.

Baking soda cleaning is available in many locations as a service. Inhouse systems are also available that feature totally enclosed cabinets and nozzles. These systems automatically clean the entire roll surface when properly set up and loaded. They are available for all roll lengths and diameters. Press-mounting systems are available for cleaning wide web rolls in place on the press, and feature built-in media collection systems.

Cryogenic Systems use liquid carbon dioxide to produce solid CO_2 pellets (dry ice) that are then used as a blast media and sprayed from a nozzle using air pressure of 80-100 psi. While CO_2 blasting is widely used for cleaning presses, and is environmentally friendly, generally the pellets are available in sizes no smaller than .04" and the average cell diameter of a 200 line engraving is much smaller. As a result, when solid dry ice particles are propelled against the roll surface the blast media can reach only the tops of the cells and are not small enough to penetrate the cells themselves. In tests of this process, it was too aggressive and the media impact on cell walls produced significant cell damage on laser engraved ceramic anilox rolls.

Newer models of equipment feature dry ice shaved from larger blocks to create a smaller particle size, but no experience with this equipment is available.

Plastic Pellet blast media is advertised as non-abrasive to the engraved surface of a ceramic anilox roll. This anilox roll cleaning system cleaning is available in the form of a cleaning service, or equipment may be purchased for in-house use. Like other blast equipment, this equipment completely encloses the roll and the blasting process to contain noise and dust.

The polyethylene plastic media are sprayed from a nozzle propelled by a pressure of approximately 60 psi. The plastic particles employed are soft but have sharp edges that deform then rebound when striking the roll surface. This action picks deposits from the surface and carries them away with the media. The media are recyclable. After plastic media impacts the roll surface, they are subjected to an air wash system to separate the media pellets from the removed particles, and a magnetic field to remove steel doctor blade fragments. The unwanted particles are then sent to a dust collector and the media are returned to the blast unit for reuse.

Recent developments for this process include the availability of an ultra fine media designed for YAG laser engravings of 1000, 1200, and 1500 lines per inch, with wall thickness as thin as 3 microns.

Ultrasonic Cleaning - Available as a service or as equipment for inhouse use, ultrasonic cleaning systems are effective for cleaning Laser Engraved Ceramic Anilox Rolls - even those with high screen counts - but operating procedures vary greatly with the size of the roll, the characteristics of the engraving, and the design characteristics of the cleaning equipment. For example, as the screen count engraved on the surface of an anilox roll increases, cell wall thickness decreases and the engraving is more susceptible to cell damage from prolonged exposure to some elements of this process. Ultrasonic cleaning procedures tailored to the specific equipment being used and the roll being cleaned must be carefully defined and followed to prevent damage to the engraved cell structure on the roll surface.

Because of the characteristics of modern water-based inks, many ultrasonic cleaner manufacturers employ an extensive presoak cycle to soften the hardened deposits that typically plug the engraved cells of an engraved ceramic anilox roll prior to ultrasonic cleaning. This step is considered essential to cleaning without damaging the engraved substrate material and frequently comprises 80 - 90% of the total cleaning time. The presoak cycle utilizes specially formulated - and sometimes proprietary - cleaning solutions with

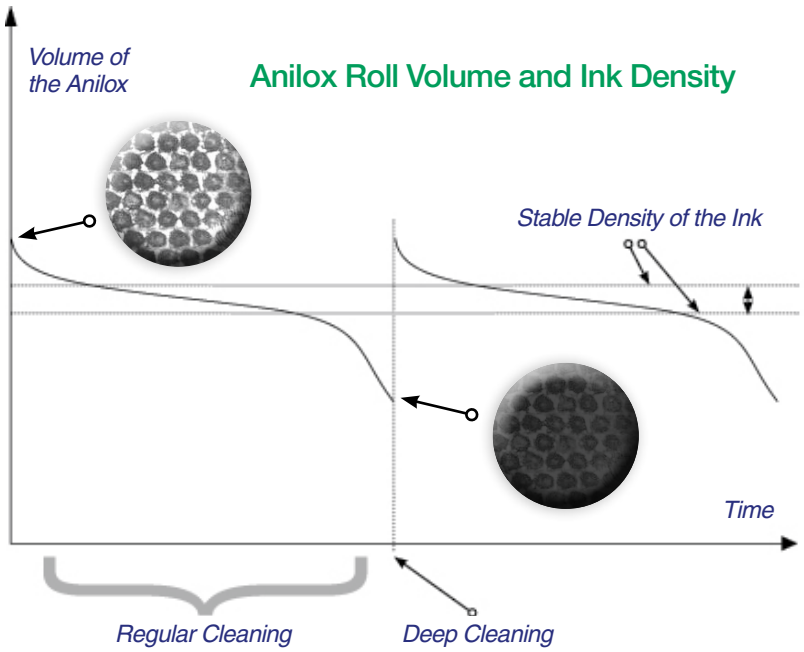
a very high pH to loosen deposits so that the ultrasonic cleaning cycle can effectively dislodge them at power levels that will not damage the surface of the roll itself. The design of most ultrasonic cleaning systems requires constantly rotating the roll while ultrasonic cleaning is underway and either total or partial immersion of the roll in cleaning solution.

The ultrasonic cleaning cycle uses sound waves to produce cavitation - the formation of microscopic gas or vapor filled bubbles by mechanical means. These bubbles are under pressure and implode when they contact the surface of the roll. The energy released at the implosion point will result in an agitation, or scrubbing action, of great intensity that dislodges material from the roll surface. This agitation by many small and intense imploding bubbles scrubs both exposed and hidden surfaces of parts immersed in the solution carrying the ultrasonic waves. Careful balance of the following factors is required to control cavitation intensity in a manner that will confine this process to the deposits and protect the roll coating:

- Ultrasonic Power directly affects cavitation intensity. Previous recommendations of a maximum ultrasonic power rating are probably not practicable with today's wide range of equipment that includes large tanks for total immersion of wide-web rolls and smaller trays for only partial immersion of narrow web rolls. The important consideration for the application of power levels is to follow the recommendations of the equipment manufacturer for a specific process.

- Ultrasonic Frequency has an inverse relationship to cavitation intensity. As the frequency increases, bubble size is reduced, as is intensity. As a guideline, a minimum frequency of 40 kilohertz (40,000 cycles/sec.) is recommended to minimize intensity and create bubbles of a size that will allow them to fit into the engraved cells where they can then dislodge deposits at the bottom of the cell. However, here again this value is not absolute. The process design of an individual piece of equipment may employ a different frequency.

- The temperature of the cleaning solution greatly effects cavitation intensity. Elevated temperatures reduce the viscosity of the cleaning solution and increase intensity, while heating is essential to the effectiveness of most cleaning solutions. Cleaning solution temperatures are normally maintained between 120°F - 140°F. Only cleaning solutions designated for specific equipment cycles, and for cleaning laser engraved ceramic anilox rolls should be used. Operating temperatures must be limited to those recommended by the ultrasonic cleaning equipment manufacturer.



- Cleaning time is critical. The longer an engraved coating is exposed to ultrasonic cavitation the more it is likely to be damaged. Many ultrasonic cleaners that employ a presoak cycle now recommend ultrasonic cleaning cycles of 5 minutes duration, or less, to ensure monitoring and protect the roll's engraved surface from substrate damage. If a roll is exposed to ultrasonic energy for long intervals, damage to the engraved cells could result. Here again, this value is not absolute. The process design of an individual piece of equipment may require a different cleaning time.

Laser Cleaning - This relatively new, and proprietary, anilox roll cleaning process uses a special laser, with special optics. The laser is tuned to protect the ceramic engraved surface, but evaporate foreign material on that surface. It is claimed by the vendor to remove dried inks, adhesives, waxes, silicones, Teflon, plate materials, and even doctor blade fragments from a laser engraved ceramic surface with screen counts up to 1200 lines, and with no damage to the engraving.

Note: The content of this publication is intended for information and further investigation only. Praxair Surface Technologies neither endorses nor recommends any of the processes or companies that offer the products or services and cannot guarantee results. The user must assume responsibility for an.y and all results and damages.

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