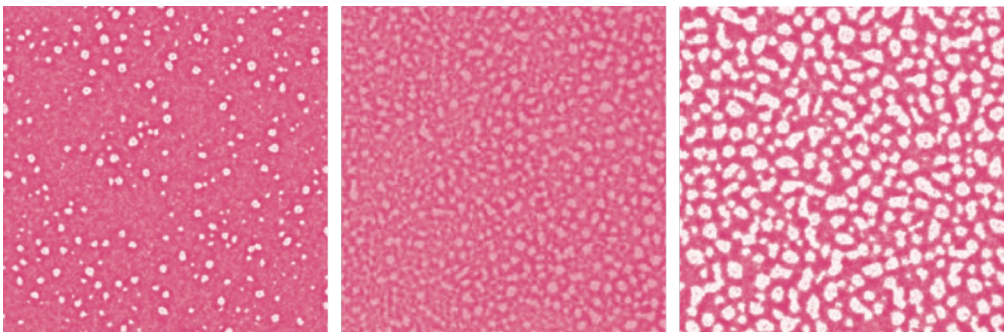
De-Wetting/Ink Density Loss v25.1

De-wetting is a printing phenomenon that results in a loss of visual and measurable ink density when a waterbased coating is applied in-line/wet-trap over conventional printing ink. When coating is removed, the ink film appears at a normal visual/measurable density, however, the addition of coating over the ink results in a 'faded', 'hazy' or 'milky' appearance. This result can appear in a single ink color or multiple over-printing ink colors and is most commonly observed on non-absorbent/low-absorbency substrates. Dry-trapping the waterbased coating over dry/cured ink will not produce this result compared to in-line/wet-trapping.

Waterbased Coating – De-Wetting/Ink Density Loss

Scope

- De-wetting is attributed to the incompatibility/insolubility of the wetting agents used in a waterbased coating and the wetting agents used in fountain solution chemistry that is latent in the applied ink film.
- The result of this incompatibility is a discontinuous or irregular ink film containing voids and/or thick/thin ink film areas – when viewed under magnification, voids in the resulting ink film allow for beneath paper-white to become visible, creating a visual and measurable loss in ink density.
- The thicker the ink film layer containing high concentrations of fountain solution and the thicker the applied waterbased coating layer, the more significant the de-wetting result can be.
- The occurrence of de-wetting is most common when the conditions of a non-absorbent substrate, saturated/heavy ink film areas (TAC), high wetting concentration fountain solution and slow-drying coating are collectively present – in this case, changing one or more of these variables can lessen or eliminate the de-wetting result.
- The magnified images below of magenta ink solid areas demonstrate the de-wetting result in various conditions of severity and relative effect on visual/measurable color/density:



Waterbased Coating – De-Wetting/Ink Density Loss Materials

Substrate

- Non-absorbent/low-absorbency substrates are most likely to contribute to de-wetting as the fountain solution contained in the applied printing ink films along with fountain solution applied by the printing plate/blanket to the substrate in non-image areas cannot absorb/wick into the substrate surface.
- In the case of printing inks, the inability of emulsified fountain solution to absorb into the substrate surface contributes to slow 'setting' and drying rates of the ink layers and traps residual fountain solution droplets in the ink film.
- Fountain solution that is transferred to the non-image areas of the substrate contaminates the substrate surface with moisture that can be absorbed into printing ink applied in these areas by subsequent printing units increasing the total concentration of fountain solution contained in the subsequent ink film layers.
- In circumstances where de-wetting occurs, the substitution of a more absorbent stock can cause this result to improve or become eliminated.

Substrate Temperature

- Substrate temperature compared to ambient conditions for temperature/relative humidity can influence the surface condition as it pertains to moisture absorption for paper or the presence of moisture when using non-absorbent stocks.
- Cold stock un-wrapped in warm conditions that are high in relative humidity can cause moisture to condense on

	the substrate surface, resulting in surface-wicking in the case of paper and surface contamination in the case of non-absorbent stocks. - During the printing process when sheets are fed individually through the press, cold paper can cause condensation on the paper surface which can result in excess moisture absorption prior to and during the printing process and contribute to slow setting of subsequently applied ink films. - Substrates should be completely acclimated to ambient press-room temperature conditions prior to un-wrapping and use.
Paper Moisture Content	- Paper will typically be manufactured with a moisture content of 4-7%, with 5-6% being most desirable for sheetfed applications. - The moisture content of the paper in addition to the surface coating will influence the absorbency of moisture and fountain solution through the paper surface. - Paper that is high in moisture content will impair the absorbency of fountain solution from the printing inks and printing unit non-image areas.
Paperboard Surface Coating	- De-wetting can occur when using paperboard that has a surface coating that can impair moisture absorption into the substrate. - Paperboard substrates that are constructed with a surface coating with high hold-out/low-permeability can result in poor moisture absorption from the applied ink/coating films contributing to a de-wetting occurrence. - PE coated paperboard and 'bacon board' substrates are highly susceptible to de-wetting incidents. - The substitution of a paperboard product that has a more porous and permeable surface coating can result in an improvement or elimination of de-wetting.
Non-Absorbent Substrate Surface Energy	- When using non-absorbent substrates, it is important that the surface energy/tension of the stock is sufficient to promote adequate wetting of all applied ink, fountain solution and coating films. - Insufficient substrate surface energy can result in poor flow/wetting and reticulation of the applied ink/coating films and contribute to an effect that is similar in appearance to de-wetting. - In certain cases, due to an uneven and irregular ink/coating film being applied to low surface energy substrates, de-wetting can occur in conjunction to ink/coating film reticulation resulting in a severe circumstance of visual and measurable ink density loss. - Prior to printing, the substrate should be tested using dyne test solutions to make a determination of the actual surface energy/tension of the printing material – for reference, >38 dyne/cm is an accepted industry standard for surface energy to promote adequate wetting for lithographic inks and coatings. - For more information regarding dyne testing or to source testing solutions, please consult the website **www.accudynetest.com**.
Printing Inks	- High-solids printing inks should be used to achieve a color-match at a thin ink film that contains a minimal amount of fountain solution. - Inks that are formulated with good 'water-fighting' qualities should be employed to minimize fountain solution absorption into the ink – this is particularly important when using non-absorbent substrates as a high concentration of fountain solution contained in the applied ink film is a key contributing factor to the de-wetting result. - Slow-drying, stay-open' ink types should be avoided along with any ink additives/sprays that may impair/retard the setting/drying rate of the inks. - Inks should be run at reasonable/controlled ink densities to avoid excessive fountain solution 'pickup' by the inks that can contribute to a poor ink/fountain solution emulsion stability. - Utilize UCR (Under Color Removal) to control over-printing ink areas (TAC)/densities to promote improved ink setting/drying and reduce the amount of fountain solution that can be contained in the applied ink layers. - Printing aids such as 'takeoff bars' to increase ink consumption/through-put can help to prevent an excessive amount of fountain solution contamination into the inking unit and maintain good ink emulsion stability. - When running special ink colors on non-absorbent stocks, increased pigment strength/high-solids should be considered and discussed when ordering from the Ink Supplier.
Fountain Solution	- Fountain solution chemistries formulated for non-absorbent substrates are recommended and should be dosed to the Manufacturer's recommendations.

	- Fountain solution chemistries containing slow evaporating glycol components should be avoided – if possible, the use of IPA as a wetting aid in the fountain solution is recommended. - Fountain solution parameters such as pH, conductivity, temperature and Brix % should be monitored regularly and fountain solution should be re-batched prior to use on problematic jobs or jobs that are suspected as a problem. - A Brix measurement of (1.5 - 1.8%) is recommended for proper solution wetting – >2.0% can be problematic. - When using an automated dosing system for fountain solution batching/mixing, it is important to test and maintain the calibration of this system to avoid improper dosing.

Waterbased Coating – De-Wetting/Ink Density Loss Process Considerations

Printing - Ink Sequence	- The sequence of printing inks has proven to influence the effects of de-wetting on printing jobs. - The first-down ink in the print/press sequence tends to exhibit the least effects for de-wetting due to: • No sheet surface contamination with fountain solution by previous printing units. • Increased dwell for ink setting prior to waterbased coating application. • Increased dwell for fountain solution absorption/evaporation prior to waterbased coating application. • Improved condition of printing inks for ink/fount emulsion stability by contact/impression with subsequent printing unit blankets prior to waterbased coating application. - Transversely, the last-down ink in the print/press sequence tends to exhibit the most significant effects for de-wetting due to: • Sheet surface contamination with fountain solution by previous printing units – non-image area of previous printing units where fountain solution is applied to the substrate becomes an image area on subsequent print units where ink is applied. • Minimal dwell for ink setting prior to waterbased coating application. • Minimal dwell for fountain solution absorption/evaporation prior to waterbased coating app - Due to these variables, it is typically observed that the incidents of de-wetting become progressively worse from the first-down ink to the last-down ink, with the last-down ink showing the most significant result. - De-wetting results for individual ink colors can be observed on the color bar IF the color bar has waterbased coating applied – inspecting individual ink color control patches can help in the troubleshooting process. - When running a problematic special ink color, it may be beneficial to run this color first-down as opposed to last-down to improve the results for de-wetting. - If the printing press has enough printing units, leaving units open and on impression after the last ink color and prior to waterbased coating application can improve the overall results as mentioned above – moving ink colors towards the feeder and leaving last printing units open can be beneficial.
Waterbased Coating Product Selection	- To avoid prolonged interaction between wet ink film layers and a wet waterbased coating film that can contribute to a de-wetting occurrence, it is important that the appropriate drying-rate waterbased coating product is selected for problematic jobs. - In the case of non-absorbent substrates, special 'fast-setting' coating products will be necessary to ensure proper drying rates as moisture absorption into the substrate to facilitate drying is not possible – waterbased coating drying will be solely evaporative. - Special coating products may be necessary for the following conditions: • Low absorbency/non-absorbent substrates • Insufficient or poor condition/capability press drying system • Ambient conditions for high temperature/high humidity exist in the press area - For coating product recommendations, contact your INXCAC Technical Sales Representative.
Anilox Coater	- The degree of de-wetting occurrence can be exacerbated by the amount of waterbased coating that is being applied over the ink areas – the appropriate volume/bcm anilox should be selected for the application. - Excessive coating application can contribute to more significant voids in the ink film as the coating film migrates into the beneath ink layer/s. - In cases where de-wetting occurs, the amount of coating should be observed on the sheet and determined to not be visually excessive. - The following should be checked to avoid excessive coating application: • Check coating viscosity/temperature for compliance.

	• Check for proper anilox volume/bcm if multiple rolls are available. • Check doctor-blade condition for wear in the metering position – change as needed to ensure proper roll surface metering. • Check coating blanket/plate for proper packing/height. - If lower volume/bcm anilox rolls are available, it is recommended to change to a lower volume roll and test for de-wetting results at the lower applied coat-weight.
Roller/Nip Coater	- The following should be checked to avoid excessive coating application using a roller/nip coater: • Check coating viscosity/temperature for compliance. • Check the operational setting for coating pan roller speed. • Check the operational setting for coating pan roller speed compensation curve. • Check the mechanical nip setting for coating pan roller to applicator roller. • Check durometer of the rubber roller of the coating system – softer roller will apply more coating, harder roller will apply less coating. - Reduce coating application rate until visual starvation is observed on the sheet and increase incrementally until adequate coating coverage is restored. - If coating application remains excessive, a harder durometer rubber roller may be required to improve metering – consult the press/coater manufacturer for recommended coater roller hardness.
Drying	- Proper drying system operational settings should be employed to aid in setting the ink and coating films to avoid prolonged interaction of these films in a wet condition. - Extended wet condition interaction between the applied ink and coating films can cause a de-wetting incident to occur. - Improper drying system operational settings and/or drying system condition/capability can contribute to extended setting/drying times for both ink and coating films. - The drying system condition should be determined to be fully functional with all components in good operating condition. - Proper maintenance of the drying system should be conducted at Manufacturer's recommendations. - IR emitters and reflectors should be cleaned and replaced at proper intervals to ensure optimum performance of the drying system, particularly for ink film setting/drying. - The combination of Infrared (IR), Hot-Air Knife (HAK), Air-Extraction and dwell (press speed) will all contribute to the quality of setting/drying achieved by the applied ink and coating films. - Each component of the drying process should be managed to achieve the best results for setting/drying prior to sheets reaching the delivery-pile. - If possible, spray powder should be used to improve sheet separation in the delivery pile to ensure proper ventilation and continued/progressive drying of ink and coating films. - For more information regarding drying system settings/operation, please consult the INXCAC Waterbased Coating - Sheetfed Drying technical document.