Paper and Aqueous Coat Performance-Blocking & Setoff

Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

During the run, the aqueous coating appeared to be dry but later, maybe even days later, the finished load showed evidence of blocking where the aqueous coated film from the second side printing stuck together with the coated film from the first side printing.

Description

In this case, blocking or bricking defines the sticking together of adjacent coated sheets in the load, whereas, setoff or offset refers to the transfer of wet ink from one adjacent printed sheet to another.

Most all aqueous coating formulations used in conventional sheetfed offset are thermoplastic chemistry which dries by evaporative means. Basically, the water evaporates while the remaining solids polymerize into a semi-permeable, dry but pliable, film. This dry film is micro-porous which allows for the slow oxidation of the underlying inks.

A broad diversity in porous and non-porous substrates in conjunction with many various coater/dryer configurations has created the need for hundreds of different aqueous coating formulations creating a variety of aesthetic effects. Matching and optimizing the right coating formulation for substrate, coater, press, and function can be a difficult task without a clear understanding of individual coating/drying requirements and inherent variables.

A significant dynamic within the drying process is the substrates proclivity for moisture absorption and retention. Paper and non-porous substrates significantly vary with respect to surface porosity and absorptivity, which greatly influencesthe effective drying of the aqueous overcoat. Other key variables include coat film thickness, viscosity, temperature, and humidity. Ideally, effective drying is achieved with the proper balance between absorption and evaporation using minimal heat and maximum air flow through the drying system. Choosing the right aqueous coating formulation to compliment the substrate and press/coater/dryer configuration is critical in minimizing the potential for problems which may lead to blocking.

Causes

- Slow or incomplete dry of the aqueous coat.
- Paper not properly acclimated to pressroom environment.
- High pressroom ambient humidity.
- Coat film is too heavy or high in viscosity resulting in slow or incomplete dry.

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- Coat film is too weak or low in viscosity and not effectively wetting out over the ink.
- Coating is too cold or inadequately mixed.
- Low or inadequate air flow through the drying system.
- Paper absorbs and retains excessive moisture through the drying process.
- Ink and/or fountain solution is not compatible with aqueous coating.
- Slow ink dry or ink exuded through a weak aqueous coat film causing offset.
- High heat on the back-side printing re-softened the coating from the first side printing.
- Excessive pressure in load; pile too high, or lack of adequate spray powder.
- Incompatible aqueous coating formulation.

Options and Solutions

- **Paper should be fully acclimated to pressroom temperature** while still packaged in original skid, carton, or ream wrap. Industry recommendation is 24–48 hours depending upon temperature differential and volume of paper. Ideal pressroom climate control is 45% (+/-5%) Rh at 72° F. for North America and 52% (+/-5%) at 21° C. in Europe (See Sappi tech tip on Paper Conditioning & Characteristics).
- **Press speed** – As press speed increases, dwell time through the drying system decreases. When increasing press speed, re-evaluate the coated sheet for dryness.
- **Adjust metering speed and/or roller nips to optimize coat film thickness.** Blade coaters have anilox rolls with BCM ratings within a definitive viscosity range. The lower the viscosity, the thinner the coat film.
- **Check for recommended viscosity to the low side tolerance** with a #3 Zahn cup when coating is at optimum operating temperature, usually 75–77° F. (24–25° C.). Attention should be given to potential ink back-trapping with lighter coat films and viscosities.
- **Temperature affects viscosity; thoroughly stir new drums to completely mix coating before checking viscosity or beginning production.** The colder the coating, the higher the viscosity. Non-climate controlled pressrooms might consider an adjustable thermal-electric drum wrap with a slow-speed, bottom-up mixer to maintain optimum temperature of coating. Avoid over-agitation which may result in foaming.

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— **Expedite evaporation and minimize moisture retention by maximizing air flow through the dryer system.** Incoming air knife volume (preset to ambient temp) over the sheet and moisturized hot-air evacuation should always be maintained at maximum capacity. This may necessitate running some newer, automated systems on manual control to avoid excessive heat and cycling variables that may reduce air flow volume. In addition, high volume exhaust ducting with an up-tunnel exhaust fan will insure adequate removal and replacement of the humid hot air from the drying system to accommodate at least twice the volume of the incoming air.

— **Insure proper ink/water balance and ink/fountain solution compatibility** and avoid over-use of glycol-based alcohol substitutes. Inks should be low-solvent, low-wax, or wax-free with relatively low water pick-up while having quick-set capability to allow for good “wetting-out” of the coating. Low-solvent ink formulations usually have drier packages best suited for slow but complete oxidation under the micro-porous aqueous coating. Wax-free ink is especially recommended for off-line aqueous coating over dry ink.

— **Wind loads and allow pile heat to completely dissipate before proceeding with the back-up pass.** Dark-pigmented inks and heavy mass-tone ink coverage are more susceptible to blocking due to higher heat absorption and retention. Spray powder usage should be increased and finished loads should be racked in short lifts on the final back-up pass.

— **Excessive heat on the 2nd side can re-soften the coating on the 1st side printing.** This is especially true of softer, high-gloss coatings. A general consideration for pile temps is 90–95° F. (32–35° C.) for the 1st side with an IR heat reduction to 85–90° F. for the back-up. While maximum air flow over the sheet evaporates and dries the coating, heat is largely responsible for drying the ink. Lighter ink coverage should allow for lower IR temperatures. Pile temps should be optimized with IR heat with minimal or ambient air knife temp. Pile temps should never exceed 100° F. (38° C.). Various coating formulations have different tolerances for heat. Consult your supplier.

— **Avoid high pile heights and high pressure load banding.** After pile heat has completely dissipated, secure loads laterally with stretch wrap for transport and avoid storage/transit in hot, humid conditions. Projects with heavy ink coverage may demand additional dry time for full ink oxidation prior to high stacking or converting. Recommendations vary from 24 to 72 hours. Moderate use of spray powder will help maintain sheet separation.

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— **Consider a coating formulated for higher block resistance.** Aqueous coating formulation should be compatible with substrate and press/coater/dryer configuration. Consult with supplier on a faster drying formulation. Certain polymers in combination with slip agents may provide additional block resistance. Higher gloss coatings are softer and may block more easily, whereas, work and turn gloss coatings are usually formulated to better resist blocking.

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