Paper & Aqueous Coat Performance / Sheet Curl & Distortion

Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

The printed and over-coated sheet demonstrates excessive up-curl and distortion in the press delivery after surface dry and tightening of the aqueous coating.

Description

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

One significant variable within the aqueous coat/dry process is the substrates proclivity for moisture absorption and retention. Paper grades vary, and depending upon design, finish, basis weight, and density, surface porosity and absorptivity characteristics can greatly influence the effective drying of the aqueous overcoat. Ideally, effective drying is achieved with the proper balance between coating absorption and evaporation using minimal heat and maximum air flow through the drying system. Choosing the right aqueous coat formulation to compliment both the substrate and coater/dryer configuration is critical in minimizing the potential for excessive moisture absorption which may result in excessive sheet curl and distortion.

Causes

- Paper not properly acclimated to pressroom environment.
- Ink coverage too light.
- Excessive IR dryer heat; pile temps in excess of 100° F. (38° C.)
- Coat film is too heavy.
- Coat film is non-uniform from edge-to-edge across the sheet.
- Coating viscosity is too high.
- Coating is too cold or inadequately mixed.
- Paper substrate basis weight is too light.
- Excessive fountain solution transferred to the sheet through the units.
- Coating formulation not compatible with substrate resulting in quick and excessive moisture absorption.
- Poor air flow through the dryer system.

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— Paper absorbs moisture too quickly.

— Spotty, light ink coverage not capable of blocking coating absorption into sheet.

— Press speed too slow; dwell time too long through dryer.

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).

— **Run the heavy ink coverage side of the form first and/or run solid ink take-off bars on the corners and edges.** Ink will function as a barrier and block excessive moisture absorption into the sheet. This will minimize the potential for severe corner and edge up-curl and help the sheet lay flat in the delivery.

— **Check pile temp and reduce IR heat to a minimum.** Excessive heat accentuates sheet curl, which is usually more pronounced on forms where light ink coverage exposes the sheet to higher coating absorption. Since the primary function of IR heat is to dry the ink, light ink coverage forms may allow for lower IR heat and pile temps. It is generally advisable to keep pile temps under 100° F. (38° C.) and never exceed 105° F. (39° C.). Consult with coating supplier.

— **Adjust metering speed and/or roller nips to reduce/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 and parallel metering and transfer roll nip points and when overall coating, coat as close to sheet edges as possible.** This consideration will result in consistent and uniform coat weight and moisture absorption across the sheet surface with less potential for an unstable tightedge condition.

— **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.). Check potential for ink back-trap with lighter coat films and viscosities.

— **Temperature affects viscosity.** 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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- **Consider paper substrates of 80# (118 gsm) basis weight or higher.** Lightweight stocks may demand “higher solids”, more flexible “low-curl” coating formulations. When coating lightweights, it may be beneficial to run the first side without coating. The coating can then be run in-line on the back-up with a third, coating only, pass back over the first side. Inks should be wax-free for effective dry-trap coating.
- **Reduce fountain solution to the plate.** This consideration, in addition to using inks with lower water pick-up, will further minimize moisture transfer to the sheet.
- **Consider a “low-curl” coating formulation.** These high-solids coating formulations with the inclusion of waxes, plasticizers, or latex offer higher surface holdout and more flexibility with less water application and absorption into the paper. Consult with coating supplier.
- **Increase evaporation and minimize moisture retention by maximizing air flow through the dryer system.** Incoming air-knife air volume over the sheet and moisturized hot-air evacuation should always be maintained at maximum flow capacity. This may necessitate running some newer, automated systems on manual control to avoid excessive heat and cycling variables that reduce air 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 up to at least twice the volume of the incoming air.
- **Paper has low moisture content.** Web paper is manufactured to lower moisture content as compared to sheetfed paper but is often converted for sheetfed use. Paper with lower moisture content may demand special highsolids, low-curl coating formulations as described above.
- **Activate and optimize the sheet de-curler if applicable and rack loads in shorter lifts.** Taping-off the outside edges of the de-curler may improve efficiency for under-sized sheets. However, the sheet de-curler is primarily designed to reduce sheet down-curl, so it may be counter-productive to engage the de-curler for severe up-curl.
- **If curl can be minimized enough to improve sheet delivery, higher press speed may further improve the condition.** Higher press speeds decrease dwell time through the dryer which, in turn, will minimize moisture absorption into the sheet.