Slow Ink Set & Dry

Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

The printed ink film is too tacky or wet to the touch necessitating prolonged wait time for turn on press or cut in the bindery.

Description

There are three mechanisms to the conventional sheetfed ink drying process; absorption, evaporation, and oxidative polymerization. The first stage is the setting process where the ink bonds to the paper through absorption. Setting and evaporation take place immediately and simultaneously even as the printed sheet transfers from unit to unit through the print process. As the ink sets and evaporates, its viscosity rises, the surface tack breaks, and the ink film begins to change from liquid to solid. The final stage of the process is called oxidative polymerization, a chemical reaction where oxygen initiates a crosslink with the drying oils resulting in a hard dry.

Even though not completely dry, the printed sheets can usually be handled for back-up on press when the ink is adequately set. The time needed for sufficient ink set can vary depending upon the ink absorbency rate of the paper, the quickset capabilities of the ink, and the interaction of the printing system. The property of paper associated with ink absorbency is often termed holdout. A paper surface with high holdout capability generally cannot carry as much ink and water as compared to a surface with lower holdout or quickset capability. The advantages of high holdout are sharp dot reproduction, reduced consumption of ink and water, higher retained ink gloss, harder ink dry, and better scuff resistance, whereas, the advantages of a quickset surface is that it can be handled sooner. However, there are opportunities to improve ink set for quicker turns without sacrificing the benefits of high holdout.

Once press settings and chemistry are fully optimized as itemized below, the focus to achieve quick ink set and dry should be on minimizing water transfer to paper, avoiding over-emulsification of the inks, and quickening post-print evaporation of ink/paper water pick-up through the sheet delivery process.

Causes

- Ambient relative humidity is too high (over 60%).
- Paper is too cold and not properly acclimated to pressroom temperature.
- Ink film is over-emulsified.
    - Fountain solution is too acidic or dosage is too high.
    - Ink/water out of balance; too much water to the plate.
    - Ink water pick-up is too high.

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  - Improper ink/water form settings and/or durometer too hard.
  - Ambient and press operating temps are too high.
  - Fountain solution is contaminated; conductivity too high.
  - Ink and fountain solution are chemically incompatible.
  - Light ink coverage; slow fresh-ink displacement.

— Ink/varnish film is running too heavy for the intended formulation and color.

— Paper is absorbing excessive moisture from fountain solution transfer in up-stream print units.

— Ink formulation and/or ink set rate not compatible with absorbency rate of the substrate surface.

— Printed sheet lacks air exposure to stimulate evaporation and oxidation.

Options and Solutions

— Check ambient relative humidity and dehumidify or air condition to an Rh of 40-50%. Ideal pressroom environment is 45% (+/-5%) RH @ 72° F. for North America and 52% (+/-5%) Rh @ 21° C. for Europe (See Sappi tech tip on Paper Conditioning & Characteristics).

— Once unwrapped, cold paper in a warm pressroom cools its surrounding air resulting in condensation and an increase in relative humidity. This resulting moisture gain will impede ink set and dry. Allow paper to fully acclimate to pressroom temperature before unwrapping. Paper acclimation is relative to volume of paper and environmental extremes, but the industry-accepted best-practice is 24-48 hours.

— Switch to a fountain solution buffered to a pH of 4.0 or higher; preferably higher (In Europe printing systems tend to run more alkaline, recommending a pH no lower than 4.8).

— Check fountain solution dosage by conductivity and follow supplier recommendation.

— Adjust ink/water balance to compliment the surface holdout (absorbency) of the paper or non-paper substrate. High holdout substrates cannot carry away as much ink and water as more absorbent substrates. Start with minimal ink/water feed and a light, visible scum line at the lead edge of the plate and then add ink/water as needed to match color. When balanced, the plate surface should exhibit a light, velvety sheen.

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- Discuss ink water pick-up percentages with ink supplier. Dynamic ink temperature affects ink tack and viscosity. Hot operating temps lower ink viscosity which increases water pick-up.
- When running alcohol-free, nip points and roller durometer within the dampening system are much more critical and may differ from OEM specs. Typically, the metering roll requires a lower durometer, (18–22 Shore A Hardness) and the nip point between the chrome and the water form should be reduced to 3-5 mm (1/8 – 3/16") to maintain desired slippage. Be sure to adjust the skew to uniformly wet the plate from center to the edges using the lead-edge scum line as an indicator. There are many different dampening system configurations, and OEM specs may not be conducive to effectively print with alcohol substitutes. Consult with suppliers for specific recommendations.
- Most ink suppliers recommend ink operating temps of 75-83° F. (24-28° C.) as measured and averaged by a hand-held non-contact IR thermometer from various points across the ink train away from chilled oscillators. Consult with ink supplier and maintain chill temps accordingly. Fountain solution should also be chilled to maintain a pan temp of 65-68° F. (18-20° C.).
- Fountain solution contaminated with press washes, ink sludge, and paper debris can lose effectiveness resulting in the need for increased water feed to the plate. Clean and flush the circulating system. When replenishing, check fountain solution dosage by conductivity, and de-oxidize ink rollers as needed. This should be a weekly maintenance consideration.
- Ink and fountain solution should be tested for compatibility, including ink water pick-up, conductivity drift, pH drift, and color bleed. Consult with suppliers.
- Use ink take-off bars for light ink coverage whenever possible.
- Ink formulation may need to be strengthened to achieve desired color without running too heavy. A thinner ink film will also allow for less water to the plate and less water pick-up.
- Avoid the addition of driers or other ink modifications without consulting with ink supplier. In some printing systems the addition of a drying stimulator to the fountain solution may beneficially interact with the driers in the ink. Consult with suppliers.
- Avoid wet-dusting paper in open, up-stream print units. Keep fountain solution metering as low as possible.
- Select the ink formulation best suited for the job and substrate. Ink set rate should be compatible with absorbency of the substrate surface. For example, a tight-surfaced, high-holdout paper may require a quicker-set ink.

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— There are several ways to stimulate ink set and dry by quickening the evaporation of water and solvent from the ink film while exposing the printed sheets to the oxygen needed for crosslinking and polymerization..

- IR heat accelerates absorption, evaporation, and oxidative polymerization. Note that load temps actually increase as the ink film chemically oxidizes. Maintain load temperatures at 92-97° F. (33-36° C.)
- If the press has an aqueous coat dryer, utilize the hot air knives and hot air evacuation to stimulate evaporation and remove as much water from the ink film as possible prior to sheet delivery.
- Rack loads in short lifts commensurate with ink coverage, substrate weight, and substrate absorbency.
- Adequate and efficient use of spray powder will separate and help “air” the printed sheets.
- “Wind” printed loads in small lifts after ink has sufficiently set.

— For short run, quick turn projects, consider aqueous coating as a cost-effective alternative to waiting for ink to dry or pulling the job off press.