

# Reverse-Side Yellow Stain Effect



**Sappi Printer Technical Service**

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## Problem

A faint but visible yellow stain is apparent on the reverse side of the sheet which has been captive in the printed load. The yellowish staining may vary in intensity, but it appears as an exact back-up, mirroring the printed image on the reverse side accentuating what might be perceived as a show-through condition.

## Description

Reverse-side yellow stain describes the faint color that can appear with varying intensity on the unprinted area of the backside of the sheet mirroring the printed image from the adjacent sheet in the pile. Regardless of the actual ink/varnish color, the staining effect usually appears as a faint yellow shade. This stain effect is caused by fuming organic compounds, known as aldehydes, emitted from the drying ink which visibly discolors the shade and/or brightness of the paper. Although lab tests and press trials have produced yellow staining on papers with no optical brighteners and a similar fuming residue on acetate; chemical reactions, if any, between fuming ink aldehydes and optical brighteners in the paper have not been clearly proven or identified. However, yellow staining may be more visibly apparent on some papers due to the increased contrast of the yellow stain against the blue/white shade and high brightness of the sheet.

First researched in the late 1960s, reverse-side yellow stain is present on most all paper grades using inks that dry through oxidative polymerization, but sometimes the stain is only apparent under ultra-violet black light. Highly visible stains are usually caused by certain ink/varnish formulations in contrast with 91 or higher (GE brightness measurement) brightness papers in conjunction with prolonged exposure to high pile temps and lack of ventilation within the printed load. Lower brightness papers are still vulnerable to the effects of staining, but the lower contrast between paper brightness or shade and the yellow stain may make it appear less visible to the unaided eye.

The basic cause of the staining is believed to be the reaction between cobalt and manganese driers in conjunction with the dark yellow vegetable oil (linseed/soy) components, which emit a yellowish fume during the ink oxidation process. Press trials have determined that higher VOC inks with more solvent and lower concentrations of linseed/soy-based drying oils have less potential to stain as compared to low VOC inks, which actually have higher drier and vegetable oil concentrations. Ink formulations using Tung or chinawood drying oils, clear in color but expensive to use, have less propensity for stain.

A good test to determine the presence of reverse-side yellow stain is to compare press pull-sheets with printed sheets captive in the load. Whether viewing with the unaided eye or under black light, the pull sheets should be stain-free, whereas, the sheets captive in the printed load will show some level of staining. This comparison also demonstrates that the stain is not the result of penetration through the sheet. Highly visible and objectionable yellow stain effects are usually the result of one or more of the following conditions:

# Reverse-Side Yellow Stain Effect (continued)



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## Causes

- Ink formulations with higher concentrations of cobalt, manganese, and vegetable-based drying oils.
- Prolonged exposure to fuming ink in the printed load without ventilation.
- Excessive IR heat or pile temp builds which can speed up and accentuate the staining.
- Off-line varnishes or multiple pass overprints which may double or compound the fuming dose.
- Added dryer stimulants to the fountain solution.
- Certain ink formulations, such as match or PMS colors, with high concentrations of vegetable-based drying oils and/or weak color pigmentation loads that require running heavier-than-normal ink film thickness to achieve the desired color match.
- Dull inks and varnishes which may have especially high drier concentration packages.
- High visible contrast between the yellow stain and the shade or brightness of the paper.

## Options and Solutions

There is no way to guarantee a completely stain-free print result when using conventional inks and varnishes that dry by oxidative polymerization, but the following considerations may greatly minimize the yellowing effects:

- Press trials have proven that higher solvent inks/varnishes with reduced concentrations of vegetable-based drying oils produce less visible yellow staining (consult with ink supplier).
- Use ink formulations with alternative drier packages which minimize the need for high concentrations of vegetable-based drying oils (consult with ink supplier).
- Rack printed loads in short lifts and “wind” lifts as soon as possible.
- Run varnishes in-line whenever possible.
- Use minimal IR heat and avoid prolonged pile temps in excess of 90° F (32° C.).
- Avoid the addition of drying stimulants to the fountain solution.
- Change to a stronger ink formulation. Ink formulation should be strong enough to run optimal ink film thickness to achieve the desired color match.

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- Specify a low-alkyd dull varnish (consult with ink supplier).
- Consider overcoat techniques utilizing aqueous coatings and/or strike-through dull varnish effects, which offer high dull-to-gloss contrast while providing a semi-permeable surface that will significantly slow down and minimize the oxidative fuming process.
- If the finished job shows objectionable yellow staining, try applying an overall oil-based varnish. The incremental yellowing of the varnish may acceptably reduce the visible contrast between paper and yellow stain.