

**Litho Lamination**

# Adhesive Solution Advisor

## FIGHTING

## WARP

### Keys to Preventing and Solving Common Warpage Problems on Laminating Jobs

**Warping in final laminated sheets and other problems associated with excessive moisture in paper and corrugated stock are significant problems which often occur unexpectedly in litho lamination jobs, causing downtime and unnecessary material waste.**

**In your own litho lamination operation, you likely deal with many different combinations of printed topsheets and corrugated materials, each often produced by a different vendor in their own facility under different operating conditions.**

**The most critical of these conditions is the moisture content of the litho sheet and paperboard stock, which is affected by the ambient temperature and humidity of the facility where they are stored, and the type of ink coverage and saturation applied to the printed topsheet.**

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### **Causes of Moisture Problems in Paper Stock**

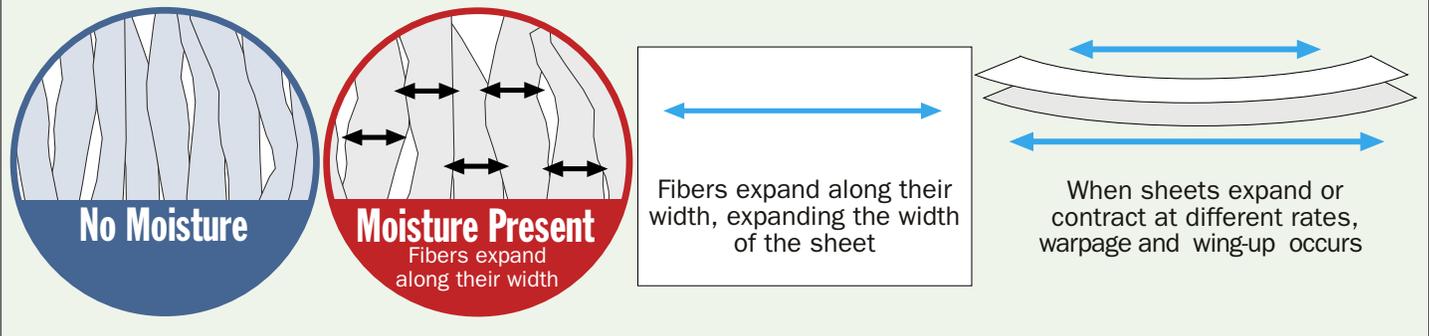
**Each of these conditions are variables which may become a problem** when the substrates are laminated and die-cut. For example, differences in moisture content between the printed topsheet and corrugated substrate can lead to warpage in the final, bonded product. Also, these variations in moisture, combined with misapplication of the wrong adhesive, can create bubbles, “tunnelling,” or cracks between the printed topsheet and corrugated substrate.

**At a microscopic level, the printed litho sheet and corrugated substrates contain fibers that run in an opposite direction to the grain of the paper used in each sheet.** Fibers in these different sheets react differently to conditions of added moisture or humidity, both when exposed to air, and when moisture makes contact with these fibers, either through the ambient air or by direct contact, such as when inks, varnishes, adhesives, or other coatings are applied directly to the printed topsheet.

**When exposed to moisture, these fibers expand along their width, and fibers in printed topsheets will expand at a different**

## How Moisture Creates Warpage

Fibers in printed topsheets and corrugated substrates absorb moisture at different rates, from the air, and from inks, coatings, and adhesives. Fibers in each of these sheets expand along their widths, expanding each sheet along its width. Once laminated, when one sheet expands (or contracts) more than another, warpage of the entire finished sheet occurs



rate than those in the corrugated board to which they are laminated. As the fibers swell along their width, this difference in expansion occurs along the width of the sheet. It is these different rates of expansion between the topsheet and substrate (or expansion of either the topsheet or corrugated substrate alone) that cause warp in the finished sheet, creating unnecessary waste and complicating final die-cutting and finishing operations.

## Solving Moisture-Related Lamination Problems: Key Steps Before Running the Job

The first step in solving moisture problems in lamination is to examine the moisture content of stock before running the job. Assuming that your facility maintains a humidity controlled environment, topsheets and corrugated material received from other vendors should always be checked for excessive moisture levels; if high moisture is detected, this material should be given sufficient time to reach a lower humidity level on your shop floor before processing.

Another important consideration is application of adhesive. When mounting or labeling, applying the thinnest amount of

adhesive necessary to the printed topsheet side only, instead of applying adhesive to the corrugated sheet (which requires more adhesive because of its higher absorption

rate), reduces the amount of adhesive required for the job and minimizes the additional moisture which is added to the finished sheet.

When laminating directly over corrugated flutes, apply adhesive parallel to the flute tops of the corrugated sheet only, instead of applying adhesive sideways across the flutes, to reduce the amount of adhesive that is pushed between the flutes, which wastes adhesive and adds more moisture to the sheet.

Of course, when the job is completed, operators can also sometimes mitigate warpage problems by reverse-stacking finished sheets to attempt to equalize the direction of warp between one stack of sheets and another. However, this approach can't always be relied on to completely eliminate warp in the final product, so it's better to head these potential moisture problems off before the job is run.

Since problems with warp can happen unexpectedly, and at any time, and can't be predicted due to the uncontrolled conditions under which topsheets and substrates were printed and produced, taking these proactive

Differences in expansion rates between printed topsheets and corrugated substrates cause warpage in finished laminated pieces

steps can help you avoid problems before they occur.

**Another key factor in preventing warpage is the choice of adhesive you use in your lamination projects.**

Selecting the wrong adhesive for a project, or applying the right adhesive incorrectly, not only introduces unwanted moisture into a job, but also adds its own complications to the moisture problems that cause stock warpage. Because of this, clearly there's a need for a better understanding of the role adhesives play in causing these problems—and in solving them.

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## The Downside of Resin-Based Adhesive: Higher Speeds Increase Warpage Potential

**To increase production speeds, litho lamination operators have switched from traditional dextrin-based (corn starch base) adhesives to synthetic co-polymer resins** having higher tack rates and shorter drying times. When slower-drying dextrin-based adhesive is used, high moisture levels in a topsheet, for example, usually had time to “equalize,” or dissipate its moisture content, by transferring some of this moisture content to the air and to its corrugated substrate, as the dextrin-based adhesive cured. However, the tradeoff for higher speed using resin-based adhesive means that moisture levels between the printed topsheet and corrugated substrate often no longer have sufficient time to equalize as the these two sheets are bonded together and dry more quickly, given the faster drying times of resin-based adhesives.

**Look to your adhesive choices to prevent these cost-killing problems in your litho lamination production:**

- **Warp**
- **Bubbling**
- **Cracking**
- **Increased neoprene band replacement**

**Printed topsheets and corrugated substrate stock each hold and release moisture in different amounts, and at different rates.** The imbalance in moisture content which sometimes occurs between the topsheet and substrate works along with faster adhesion of resin-based adhesive to create the perfect conditions for warpage in the final product.

**For example, a topsheet bearing higher moisture content, bonded quickly to a corrugated sheet having lower moisture content,** will slowly contract along its width as the moisture content held within its fibers decreases naturally over time. However, because this moisture-

imbalanced topsheet is now firmly bonded to its corrugated substrate, with a dry layer of resin-based adhesive blocking the equalization of moisture which would normally transfer from the topsheet to the substrate below, moisture from this shrinkage now transfers across the entire width of the topsheet only, which also pulls the substrate along with it along this same width, causing warp.

**When slower-bonding dextrin-based adhesive was used in the past, moisture levels in topsheets and substrates had more time to reduce and equalize,** as moisture transferred from one sheet to the other, which helped to naturally ease the potential for warpage to occur due to this loss of “moisture equilibrium” between each sheet. Of course, this longer drying time means lower operating speeds, which means lower output and higher production costs for you—a significant downside to using dextrin-based adhesives and a big reason why operators have switched to resin-based adhesives.



## Dextrin vs. Resin? With Hybrid Adhesives, Now You Don't Have to Make a Choice

Fortunately, there is a workable adhesive solution for most of your litho lamination projects that also greatly reduces the risk of warp and other moisture-induced problems. Hybrid adhesives, which contain a mix of both dextrin and resin emulsion, combine the speed of resin-based adhesive with the "lay-flatness" of dextrin-based adhesives to solve many of your moisture-related production problems.

These new hybrid adhesives, containing a mixture of dextrin and resin emulsion, are combined with additional lay-flat additives to mitigate many of the "moisture equilibrium" problems occurring between topsheets and substrates.

Hybrid adhesives, such as Evans Adhesive's ResDex™, are suitable for the vast majority of your litho lamination jobs, and also provide other key advantages compared to resin-based adhesive:

- **Production speeds using hybrid adhesives are equal** to those for resin-based adhesives, so your production rates will be unaffected by the changeover;
- **Hybrid adhesives can be applied at a lower thickness** (5-6 lbs. per M.S.F compared to 8-9 lbs. per M.S.F for dextrin-based adhesive), which lowers your cost of materials for each job;
- **In addition to savings from lower material usage**, hybrid adhesives are approximately 10-20% less expensive than resin-based adhesives;

### Benefits of Hybrid Adhesives:

- **Fast production speeds**
- **Thinner application rates vs. dextrin**
- **Less expensive than resin-based adhesive**
- **Pieces can be die-cut and finished within two hours or less**
- **Reduces neoprene band deterioration**

- **As with resin-based adhesives, final adhered sheets bonded with hybrid adhesive can be die-cut within two hours or less** after mounting or lamination, with no long delays due to drying time;
- **Unlike resin-based adhesives, hybrid adhesives do not cause early deterioration of neoprene bands** in your Automatän machine; this saves repair cost and downtime in your production flow

If you've experienced the higher costs of wasted materials and production delays caused by warpage and other related problems, being aware of these key guidelines can help you stop moisture-induced warpage problems before they become a problem in your production operation. Also, give careful consideration to the role played by your choice of adhesive used in each job.

**With hybrid adhesives, you no longer have to make tradeoffs between the speed of resin and the easier workability of dextrin:** This is one place where you can truly have the best of both for the majority of your litho lamination projects.



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