Buckling at the Spine

Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

The text and cover ran fine through the press; the folded signatures and finished binding initially appeared uniformly flat, but soon after binding the finished books became distorted and buckled at the spine.

Description

Buckling-at-the-spine, as sometimes experienced in perfect-binding and other forms of fixed-spine binding, is usually the result of adverse cross-grain paper re-acclimation subsequent to the binding process.

Hygroscopic in nature, paper is constantly changing to reach equilibrium with its environment. Like a sponge, paper fibers are either expanding through moisture absorption or contracting through moisture loss. This continuously changing dynamic is relative to humidity and temperature extremes of the surrounding atmosphere in conjunction with impacting process variables in production.

Since paper fibers expand and contract more in width than in length, paper will grow or shrink more in the cross-grain direction. If the book is perfect-bound with the grain of the text or cover perpendicular to the spine, a varying buckle may develop. This occurs as the paper fights the fixed spine, continually expanding and contracting while seeking equilibrium with its changing environment. If the text and cover are correctly bound with grain parallel to the spine, expansion and contraction will naturally and uniformly push out from the fixed spine to the open face. This enables the book to lay flat in a broader range of ambient conditions.

PUR (polyurethane reactive) adhesives, highly regarded for their strong, flexible, lay-flat capability, may help minimize the potential for buckling-at- the-spine. However, they can not completely overcome the hygroscopic nature of paper in cross-grain binding, especially in extreme situations as when dry heatset web signatures are bound before full re-acclimation.

PUR adhesives work well with a broad range of substrates including coated paper, but the curing process is unique in that it draws moisture from the ambient air as well as the paper. For this reason, it is important that finished signatures be allowed to fully re-acclimate before binding and bound books be given 24-hour, open-air cure time in a climate-controlled environment before being wrapped and cartonized.

Buckling at the Spine (continued)

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Causes

- Paper grain of the text and/or cover is perpendicular to the fixed spine. Dissimilar interleafed substrates, aqueous or UV coated covers, long spine lengths, and oblong books may be especially vulnerable
- The hot-melt adhesive used for the perfect-binding is too stiff and inflexible.
- Post-press transit, storage, and/or binding transpired in adversely low or high humidity environments.
- Finished covers and folded signatures were not given enough time to re-acclimate to a proper climate-controlled environment prior to binding.
- Fixed-spine books, especially those bound with PUR glue, were shrink-wrapped before adhesive was fully cured.

Options and Solutions

- Run text and cover grain direction parallel to the spine.
- Ink, varnish, and all other overcoats should be knocked-out of the inside text/cover spine and hinge-score area to maximize uniform glue adhesion.
- Use PUR adhesives for high strength and flexibility, especially on coatedpapers or applications where the paper grain can not be run parallel to the spine.
- Store and bind printed sheets and signatures in a climate-controlled environment. Ideal storage and bindery environment is 45% (+/-5%) Rh @ 72° F. (22° C.) (See Sappi tech tip on Paper Conditioning & Characteristics).
- Allotted time for re-acclimation will vary depending upon the ambient humidity of the storage area and moisture content of the printed paper, but the general consideration is 2 days for sheetfed and 4 days for heatset web in a climate-controlled environment of 45% Rh @ 72° F. (22° C.). Heatset web delivers an especially dry product demanding additional time to re-acclimate through moisture absorption. (See Sappi tech tip on Web Growth).
- Allow adhesives, especially PUR glues, adequate time with maximum exposure to cure before sealing or shrink-wrapping. Time may vary from seconds for hot-melts to 24 hours for PUR formulations.