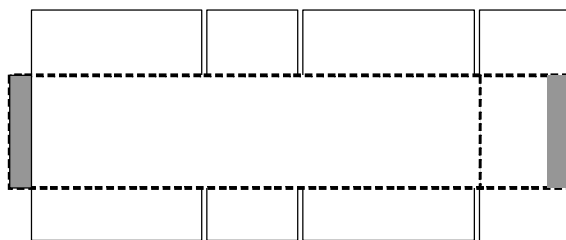


Glue Joint Failures: More Than Meets the Eye

Glue joint failures are a serious issue because they can occur when the end user's product is in the package. This can result in lost product claims against the box maker, and shake the end user's confidence in the box maker. This edition of *Paperwise* will review some important points about making glue joints, and raise key questions that need to be answered when failures occur.

Figure 1



An unglued blank for a regular slotted container.

Figure 1 illustrates a glue tab (shaded left) which has an adhesive applied to its surface or the panel (shaded right) depending on the glue applicator style. The blank is then folded and the glued tab is joined with the shaded panel at the right. This joint keeps the container intact.

Following a number of glue joint failures, an industry group drafted guidelines on how strong glue joints had to be in order to survive a package's normal life cycle. These guidelines are an important step toward defining successful performance criteria for box makers. Yet, objective glue lap testing is not always readily available to every box maker. The test devices may be located in a company's central or regional lab or not available at all. So, tearing glue joints by hand has become a common practice during folder-gluer set-up. And it is important to remember that inspection of a failure is as important as how much force it takes to fail the joint.

Factors for a Successful Glue Joint

There are three ingredients of a successful joint:

- ? A good adhesive bond

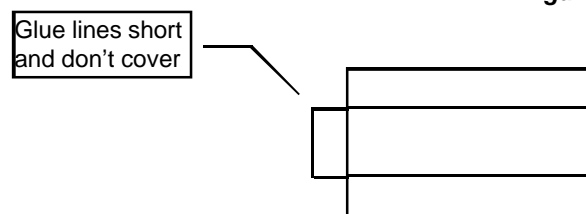
- ? Size of the bonded area
- ? Internal bond of the liners being joined

First, a sound adhesive bond must be established. A sound bond will cause one of the bonded liners to delaminate or tear. A joint with a poor adhesive bond will separate with minimal fiber pull along the adhesive contact area. There are a few reasons this can occur, and your adhesive supplier can help you address them.

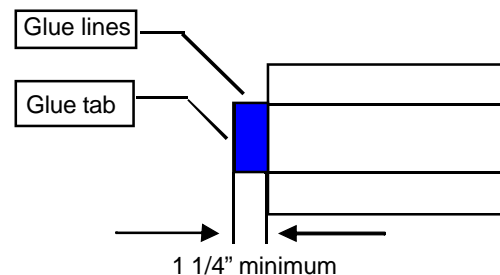
Once a good adhesive bond is created, the bond area must be maximized. Why increase the bonded area? Bonded area can be likened to a tug-of-war. The more people you have manning the rope, the stronger your team will be. Increasing the bonded or glued area in a glue joint enlists more fibers (or tug-of-war participants) in securing the joint. When the joint is exposed to shear or tearing forces, the force can be dissipated among the participants. Since the force magnitude on each fiber (participant) can be lessened, the liner will be more able to withstand it.

Whether you are using a wheel- or extruder-type glue system, alignment of the glue application is important. As Figure 2 illustrates, misalignment of the glue application and the length of the application can reduce the bonded area.

Figure 2



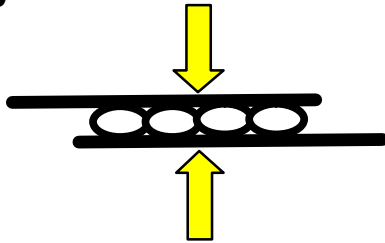
(a) Loss of bond area due to short start-stop sequence and insufficient glue.



(b) Item 222 and Rule 41 require adhesive coverage of entire contact area.

It is important that the equipment operator check the start and stop location of glue beads, as well as their positioning, to insure maximum bond area is accomplished. In addition, proper viscosity is imperative to make sure the adhesive beads spread for complete coverage when the blank is folded and the joint pressed. (See Figure 3)

Figure 3



Proper viscosity allows glue beads to flow together when compressed.

Another way to increase the bonded area, especially in a demanding application, is to use an extended glue tab. A tab of this type will “extend” into the flaps. Remember, if the extended portion of the tab is not thoroughly glued it will be of little value.

A good adhesive bond and a large bond area will not be of any use if the liners you are joining do not have sufficient internal bond. With the advent of multi-ply linerboard, especially white top, it has become easier to judge where the liner delaminates. Often the liner will delaminate between the bleached and unbleached plies. In coated liners, the failure can happen between the coating and the liner itself. **However, a failure between the linerboard's plies is not a reason enough for concern by itself because the joint must fail when enough force is applied. Rather, the important point is how much force is required to fail the joint.** This is a key point because the container may never experience the amount of force needed to fail the joint. For instance, a joint may require 12 pounds of force to fail, when during the worst case scenario, the joint may only experience four pounds of force in its life cycle.

Liner producers have a vested interest in seeing that their liners do not incur glue joint failures. Consequently, liner producers actively measure and control the internal bond strength of their liners. The testing usually involves anchoring one face (or side) of the liner to a stationary platen

(with tape) and taping the other face to movable platen. A measurable force is applied to the movable platen until the liner delaminates. The force and failure location are recorded and reported to the papermaker in case strength improvement is needed.

Smurfit-Stone's graphic liner mills employ a peel-type test sometimes called a **plybond test**. Our minimum specifications for peel strength have been correlated to glue lap joint strength by each of our graphic liner mills. Since glue joint strength guidelines are known, Smurfit-Stone papermakers know how much liner peel strength is needed for successful performance.

Key Questions When a Joint Fails

If you are plagued by glue joint problems, here are a few questions to consider:

- ? Under what conditions is the joint failing?
- ? How is the joint failing? In the adhesive bond? In the single-face or the double-face liner?
- ? Is the glue application covering enough of the tab?
- ? Is the glue tab large enough?
- ? Is the tab being damaged under handling?
- ? What are the peel results on the liner?

If you would like more information on how to improve glue joint strength or other technical topics, contact your Smurfit-Stone Sales Manager or call us toll free at 1-877-785-7835 or by e-mail: paperwise@smurfit.com