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# Techniques for bonding of densified liners

## Scope

In the quest to provide the end user with high-performance corrugated containers which achieve better stacking strength, the mills have developed a range of liners that have superior ring crush levels. If properly combined, they will yield high-performance top-to-bottom compression characteristics. This property is particularly important as the end use demands of stronger boxes, at reduced fiber levels, that will survive taller than ever before stacking levels in modern high-density warehouses.

Mills utilize a number of techniques to achieve higher compression strength, including improved fiber orientation and cross-linking, and high density formation of paper fibers through high loading rates of their presses. This densification process compresses the fibers together tighter, thus increasing the sheet's density and strength.

Densified sheets as defined above are often much less porous than the typical kraft liners utilized in the past. Decreased porosity levels can translate into reduced levels of adhesion penetration, potential bonding problems, and box performance failures. Typical adhesives formulated to bond conventional kraft liners may appear to bond well initially, but can delaminate after curing.

Densified liners are thought to bind up their moisture differently than standard or more open liners. These liners require reduced heat transfer levels and preheater wrap techniques to prevent premature adhesive gelatinization and brittle bond formation. This Technical Information Paper describes techniques to successfully combine a range of densified liners now available to the corrugated industry.

## Safety precautions

Observe all corrugator and starch mix safety precautions.

## Content

Densified liners are of a “new breed” or according to some a “different kind of animal.” We must rethink our old ways of converting if these new liner grades are to be used successfully. Applying more adhesive and running slower is not the answer. The following recommendation might offer you the solutions needed to run high ring crush liners:

1. Insure that all metering gaps, single facers, and glue machine are parallel within 0.001 inch (0.025 mm) to insure uniform adhesive application, and bond performance.
2. Insure that meter and application rolls do not exceed a total indicated run-out (out of round) sum of .004 inch (.10 mm) to avoid non-uniform adhesive application in the cross machine direction.
3. Insure that all machine center components are parallel and level to assure even tension across the web, thus yielding even heat transfer as the liner, medium, and single face web travel across a variety of heated vessels. Uniform tension is critical when running denser high ring crush liners, since their density renders them more susceptible to over heating and moisture loss. Strongly consider modifying or installing adjustable idler rolls at every liner and medium position. These adjustable idler dolls will help

the corrugator operators insure that even tension is maintained when equipment gets out of line, or when they encounter loosely wound rolls.

4. Densified liners not only heat up quicker but lose their available moisture easier. Operators must be cautioned to use as little preheater wrap as possible, and to run as fast as conditions will permit to retain as much moisture as possible within the guidelines.
5. Densified liners should be wrapped so that all available liner moisture is driven toward the glue line. This technique traps the liner's available moisture between the glue lines, which helps (1) prevent score cracking; (2) prevents over-drying the sheet; and (3) pre-wets the liner's surface which assists adhesive penetration and bond. At the single facer, wrap the liner under the 36 inch preheater. At the glue machine, wrap the liner over the 36 inch preheater. Keep in mind that we have to condition the liner's surface and bring the surface up to a temperature of 180-205°F (83 to 96°C) and medium 140-155°F (60 to 68°C) for bonding.
6. In order for Pearl based starch adhesives to penetrate the densified or light liner surface, we recommend using higher solids levels (25% oven dry minimum); higher gel points, and lower viscosity levels to allow increased penetration levels as the combined board cures. It may be desirable in some instances to use modified carriers to further improve penetration. Increased adhesive application levels are sometimes necessary to achieve the desired bond and box performance levels at the higher operating speeds of today's equipment. Adhesive application levels may have to be reduced as necessary on reduced basis weights to prevent incidents of wash-boarding.

### Keywords

Adhesives, Bonding, Liners, Ring crush resistance, Ring crush tests

### Additional information

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