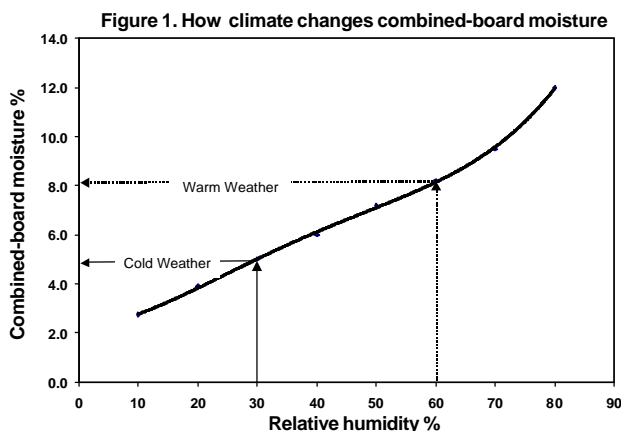


Cold Weather Warrior

The onset of colder weather can spell trouble for combined board quality, specifically scoreline checking or cracking. Scoreline cracking is when the outer liner cracks or fully fractures along a score when folded. In this edition of *Paperwise*, we explain why scoreline fracturing occurs in cold weather months and recommend some strategies to combat it.

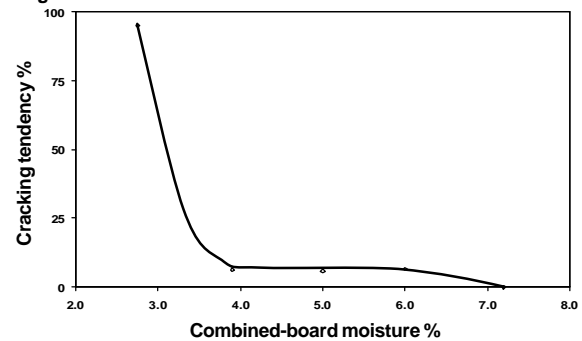
Cold Weather and Cracking

Low combined-board moisture is the single largest cause of cracking. Paper is naturally sensitive to changes in relative humidity. In cold weather, the air in your working environment is drier than during warm weather. In the presence of dry air, combined-board will lose moisture, while in more humid air – such as warm weather – it will retain or adsorb moisture from the air (see Figure 1). Even with identical corrugator settings, the change in plant humidity can cause an additional 1% moisture loss in the combined board. The end result as shown in the figure below, is the combined-board can be significantly drier in cold months.



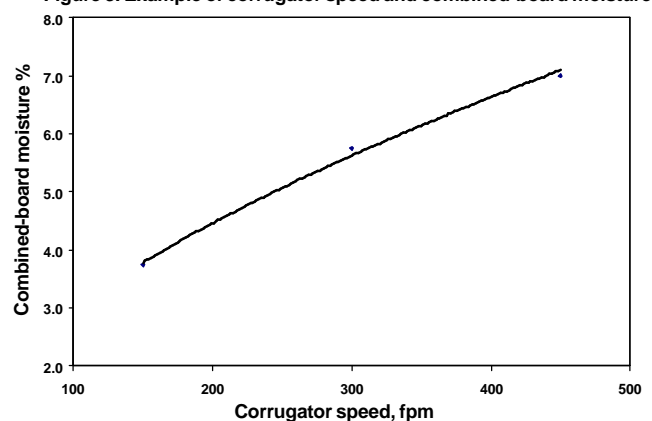
As paper loses moisture it becomes stiff and brittle and does not easily fold. As Figure 2 illustrates, as paper dries, even small changes in the board moisture will dramatically affect cracking tendency. Heavier basis weights are more prone to cracking because their thicker caliper subjects the outer surface to greater tensile stresses during bending.

Figure 2. How combined-board moisture affects scoreline fracture



Therefore, in cold weather we must make every effort to keep the combined-board moisture elevated to avoid scoreline cracking, because once the moisture is gone, it is not likely to return. Corrugator stoppages or slowdowns, excess heat, or low liner moisture are some examples of how the combined-board moisture can be dropped to problematic levels (Figure 3).

Figure 3. Example of corrugator speed and combined-board moisture



Cold Weather Strategies

Store heavy basis weight linerboard rolls near the corrugator to maintain "room" temperature for the entire roll. Rolls stored in cold conditions cool down very slowly. But they also take a long time to return to "room" temperature. A cold roll requires more heat to return to room temperature. Use the warm air around the corrugator to keep rolls warm and reduce the heat needed on the corrugator.

Monitor bond strength. Adhesive gel temperatures typically range from 145-150°F for single-face formulas and 140-145°F for double-face formulas. Board temperatures only need to be 10-15 degrees above the gel point to bond. Check green or rip bond of both the single-face and double-face liner to confirm adequate bond strength. Still not convinced? Allow your test sheet to cool before performing your rip bond test. Also, check the condition of the gluelines. If your gluelines feel like sandpaper, the adhesive gel point may be too low or you may be overheating the board.

Don't forget that single-face moisture is just as important for controlling warp as double-face moisture. Monitor temperatures at the single facer, avoid single face moisturizers by retaining the moisture in the liner and medium, and also minimize the amount of festoon you have on the bridge. A wad of festoon creates more exposure time for surrendering moisture to the air.

Dust off that temperature gun! A temperature gun is one of your best weapons to combat dry board. We recommend you measure the board temperature at the points listed in the table below. The alarm points are board temperatures at which significant risk of cracking exist with any liner. For reasons mentioned later, some liners may crack when their temperature is lower than the alarm points in the table. The liner temperature should be just high enough to produce a good bond and flat board after cooling. Remember, it only takes 150-160°F to make a good bond, and while some liner requires more heat to get board balance, in many cases board can be balanced with little additional heat.

Measurement Location	Liner Temperature Alarm Point*
Single-face web (liner side) 18 inches after pressure roll	Above 250°F
Double-face liner 6-12 inches before entering hot plate nip	Above 220°F
Double-face side exiting hot plate section (before traction or cooling section)	Above 230°F

*These are recommended maximums. You should develop baseline operating targets for your plant.

Take some baseline measurements for the type of linerboard you use. Linerboards have different tendencies to crack. This is because they have different heat transfer characteristics and fiber types. Recycled and coated liners are more prone to cracking than virgin or uncoated liners. Baseline temperature measurements of the liner will define

the best operating temperatures to avoid cracking.

Flag or chop out board in the hot plate section during a stoppage or slow down! When the flexo-folder-gluer operator notices cracking that comes and goes, it is probably a sign that the corrugator was having problems that caused stoppages or speed swings. The cost of rerunning an order is much greater than the cost of the sheets you will discard from a corrugator slowdown or stoppage.

Making the combined board with maximum moisture retention is an important part of fighting scoreline fracture. But the battle is not over.

Run the combined board through your converting operations as soon as possible. The longer the board sits, the more opportunity there is for moisture loss into the dry air. Certainly try not to park the board near cold, drafty doorways. If you are using moisture-resistant or water-proof adhesive, run the board as soon as the requirements for proper cure time are fulfilled.

If your plant purchases combined board sheets, give them ample time to warm up before converting them. Sheets drawn directly from a trailer can be at surprisingly low temperatures in winter weather. Allowing the sheet to warm up means it will be a little more pliable for folding, so space the stacks to give them some breathing room as well. If your budget allows, you can purchase a plant air humidifier to keep the plant humidity stable.

In advance of the job, check that the scoring rules are in good condition with the right height and resilient ejection rubbering. Make sure the blanket is level. Watch for cracking scores in isolated areas of the blank, it could signal faulty components.

This edition of *Paperwise* has covered several strategies to prevent scoreline cracking. The key is to recognize that plant humidity decreases in colder weather and combined board moisture drops with it. Additionally, small changes in combined-board moisture can have a dramatic effect on scoreline fracture. Monitoring a few variables and being aware of how your operations can affect combined-board moisture can help you manage scoreline cracking during those cold weather months.

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