



Make glue line analysis part of your quality control routine

This quick and easy test procedure can help you keep tabs on adhesive application and common machine issues

By Ronnie Littleton and Rex Woodville-Price

Soaking board apart and then staining it with iodine remains one of the most useful diagnostic tools at the disposal of the corrugator crew. It is easy to do, doesn't require a lot of training to interpret the results and can help pinpoint many common machine or operational problems quickly. The test results can even be recorded photographically for later interpretation or comparison.

This test works because iodine turns starch purple. Since corrugating adhesive is starch based, the purple stains reveal where adhesive has been applied.

Be aware that paper with a lot of sizing will also turn purple and will make reading the glue lines more challenging. However, at least this is valuable information also, as highly sized paper may have penetration or bonding issues and this will give you a clue to take corrective actions at the machine.

The quality of the glue line reflects the quality of bond. Glue lines are influenced by several process variables, from the application of the adhesive to the tips of the flutes at both glue mechanisms, to the final bonding in the double backer itself. The conditions under which this occurs are altered by changing machine speeds.

Examining the liner

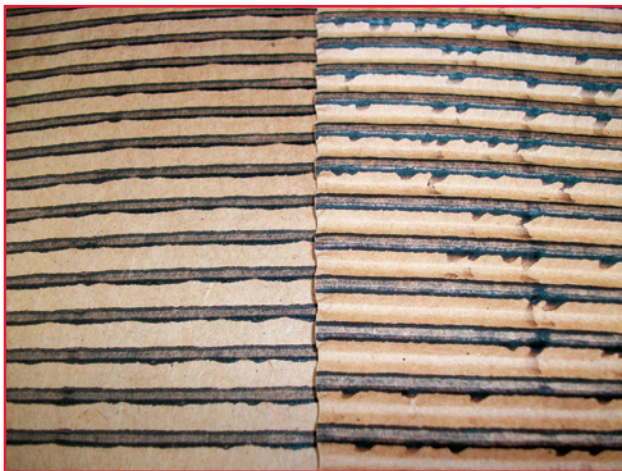
Glue lines on the liner are examined for acceptable quality; they should be solid and have consistent width all the way across the web. It is useful to mark the direction the board ran on the machine.

What the medium can tell you

In the corrugating process we apply adhesive to the medium and then transfer it to the liner when the two are joined. So it is valuable to look at the medium side of the soak samples, as well, since that is where the adhesive was applied (the liner shows only the adhesive that was transferred). Sometimes the glue lines will appear acceptable on the liner but the medium will reveal issues not apparent by analyzing only the liner.

Troubleshooting the double face glue lines

The double face bond is formed under low-pressure conditions (unlike the single face side which was formed under much higher pressure) and is therefore more affected by process variables. As speeds are increased, these variables can affect the transfer of adhesive to the flute tips and/or transfer from flute tip to liner. Application of the glue to the flute tip can be affected by the gap setting of the rider roll or contact bar, by the speed ratio of the glue roll to web, and by malformed or low flutes. If the applicator or metering rolls are worn or dirty, the application will not be even across the web. Flute tips should have a consistent film of starch covering the radius of the flute tip. (Starch on the flanks of the flutes often indicates a glue roll speed issue.)



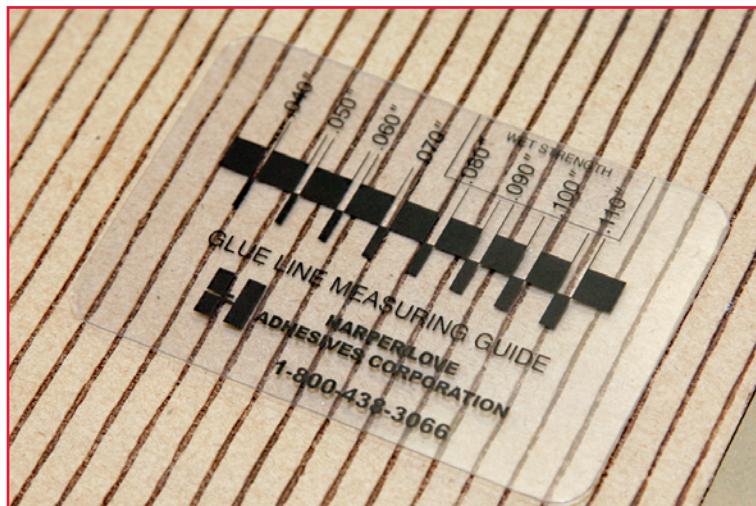
This image shows the liner (left) and the medium (right) from the same board. The glue roll speed issue can be seen on the liner while the medium shows how high viscosity is making it worse by causing dribbling down the flanks.

Here are some issues that can be diagnosed with this method

- 1. Application rate:** Glue lines should be measured with a gauge to determine their width, which will indicate whether the application rate is adequate. This is a valuable tool for determining the correct glue roll-to-metering roll gap settings. Determining the correct application rate is important not only to control adhesive consumption, it also affects run speeds, bond strength, and board quality. Proper adhesive application will help avoid problems such as warp and washboarding.

(Glue line analysis, continued)

- Glue roll speed:** Looking at where the adhesive was deposited on the flute tips will help determine the correct glue roll-to-paper speed ratio. Adhesive on the trailing flanks of the flute indicates a glue roll that is turning too fast in relation to the paper. Conversely, adhesive on the leading edges of the flute tip point to a glue roll with too much lag.
- Glue rolls out of parallel:** One of the most useful tests for determining uneven application is to compare the glue lines from the drive side with those on the operator's side. A difference in the width of the glue lines almost always indicates an out-of-parallel condition.
- Worn or dirty glue rolls:** This test is similar to the above test, except here we know the rolls are in parallel. Again, we compare the widths of the glue lines across the entire web. Since a worn or dirty area of the glue roll will transfer less adhesive, glue lines that are consistently narrower in any region of the board will point to the problem area of the glue roll.
- Hold-down pressure:** Assuming adequate flute tip coverage, poor adhesive transfer to the double face liner will usually indicate inadequate pressure in the hot plate section. Flute tips must keep contact with the liner. If the gelatinization process of the starch starts before good liner contact is established, the transfer will be reduced. Comparing the flute tip application to the liner application will help identify the true cause. Double face liner glue lines that are varying in width or broken (often called Morse Code) across the web can point to this, as well.



Glue line gages and pictures are available from your Harper/Love representative; these are great troubleshooting aids and valuable training tools.

- Slinging or dribbling:** This problem usually can be revealed only by examining the medium. Adhesive can sometimes sling or dribble and end up in the valleys of the flute (typically, it is not visible on the liner). Slinging or dribbling can be caused by improper viscosity, inadequate formulation (too much borax) or some mechanical issue. Whatever the cause, it puts adhesive where it does not belong, and contributes nothing to the bond. Adhesive is wasted.

Studying glue lines reveals a great deal of useful information, particularly about how the adhesive was applied to the medium and then transferred to the liner. A soak tank and a spray bottle of iodine should be part of every corrugator's arsenal.

Snyder to receive TAPPI award

In September, Harper/Love National Sales Representative Pete Snyder will receive TAPPI's Corrugated Division Leadership and Service Award. In 2004, Pete received the division's Bettendorf Technical Award. This makes Pete one of only three TAPPI members in the organization's history to receive the Corrugated Division's top two awards. Pete has been with Harper/Love since 1987.



Twenty-year service awards

Five Harper/Love associates were recognized recently for twenty years of service. Left to right: Jim Carbone, Pam Flynn, Bill Lopnow, Phil Smith, and Barry Mitchell.



Tape-tear test reveals directional fiber orientation

There's not much you can do about the fiber orientation of your paper stock, but knowing it is there can keep you from fixing something that's not broken

By Bill Nikkel and Rex Woodville-Price

We often encounter board that exhibits directional fiber tear—board that pulls more paper fibers when pulled apart in one direction than in the other.

The usual culprit for this phenomenon is adhesive that is not centered on the tips of the flutes. This can easily be verified using the iodine soak test to examine the placement of the adhesive. One trick to use with the iodine-stained samples is to hold the sample at eye level and sight over the tops of the flute in one direction, then turn the sample 180 degrees and sight over the tops in the opposite direction. If there is any adhesive on the flanks of the flutes, one side will appear darker than the other.

If the glue appears to be centered on the flute tips using the above method, then a different factor may be the cause: the predominant orientation of the fibers in the paper.

Here is a simple test for fiber orientation

You'll need a piece of tape. Any tape with sufficiently strong adhesive will work. Clear office tape or packing tape are best; masking tape is not tacky enough. Place the piece of tape on the liner, in the machine direction. Rub it down for a good bond. Then peel the tape back in both directions. If more fiber tears in one direction than the other, this is the cause of the directional fiber tear in the finished board. (It's useful to fold the very edges of the tape on each end before applying it so it is easier to peel.)

Note: This test should not be confused with the Scott ply bond test; the main similarity is that both methods use tape. The Scott bond test determines the internal strength of the bond between the fibers themselves and uses a test apparatus that has a swinging pendulum to knock the sample apart.

Since liners used in the corrugating process are relatively thin (even heavyweight 69-pound liner has a caliper of only 0.019 inches) we tend to think of paper fiber lying in a two-dimensional world (polar angle), but in reality, paper has a third dimension, a Z direction, however thin. But paper fibers don't always lie completely horizontally, they can have some relative angle up or down. When this happens to a significant portion of the fiber we can have paper that will tear directionally. One way to visualize this is if you were to grip the fibers by the very tip and pull them opposite the direction they lie, they would tear the paper and bring more fibers with them. If however we were to pull them in the opposite direction, the paper would resist tearing and the tips of the fiber would break, thus having much less fiber tear.

Again, there's not much to be done about paper with a directional fiber orientation, but knowing the real cause of directional fiber tear is invaluable in taking steps to correct it or minimize its impact.



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