

# ADVANCED ADHESIVES REPORT

YOUR CORRUGATING NEWSLETTER FROM HARPERLOVE

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## Troubleshooting Warp

by Wayne Porell

Warp is a familiar challenge in most corrugating plants. Understanding the root causes of warp can go a long way in helping correct it. Generally, warp is caused by three conditions:

1. A moisture imbalance between the top and the bottom of the sheet; this shows up as warp in the cross-machine direction.
2. A tension difference between the top and the bottom of the sheet; this causes warp in the machine direction.
3. Uneven stresses in the paper caused by fiber distribution or mechanical stress to the paper (e.g., a belt lift bar rubbing on the bottom liner); this will appear as twist warp.

### Moisture Imbalance

Improper adhesive application can have a huge impact on moisture imbalance, so it is a good place to start your investigation if you have warp in the cross-machine direction. A soak tank is an invaluable tool for troubleshooting adhesive application issues. When you soak the board apart it is important to look at the medium as well as the liners—the medium is where the adhesive is actually applied. By soaking the board and then staining the glue lines with iodine we can determine several things:

Methodical analysis  
will identify the source of  
the problem and reveal the  
solution.

- Is the machine set up properly?



- Is the glue roll worn or damaged (and therefore applying excess adhesive)?
- Is the glue roll running at the correct speed?
- Is the wiper blade wiping the metering roll correctly?
- Is the application rate correct (based on the width of the glue line)?
- Is the adhesive where it belongs (i.e., on the flute tips rather than on the flanks or in the valleys)?

Glue lines should be measured with a glue line measurement tool and compared with the optimal width for the specific flute. Comparing the glue lines from the operator side to those of the drive side of the sheet will tell you if the glue roll and metering roll are out of parallel.

At least 90% of the adhesive applied at the double facer should transfer from the medium to the liner.

This shows that the double backer hold-down devices on the machine are functioning correctly. At the single facer it is quite common to transfer 100%.

Excess adhesive will impart excess moisture to the board and will increase the likelihood of warp. If all the applied adhesive is not completely gelled through the corrugating process, post-warp will occur as the board dries. The optimal amount of adhesive for a given board grade should be determined by a soak test and pin adhesion test.

Not all glue machines are the same—one with a 25-quad glue roll and one with a 35-quad roll will not apply the same amount of adhesive when running with the same gap.

Up-warp or down-warp can be caused by any of the following reasons:

- Excessive adhesive application
- Run speeds not consistent with the glue roll gap
- Overheating the liner(s)
- Incorrect glue roll speed

A glue roll that is running slower than the paper speed will apply adhesive to the front side of the flute. Conversely, a glue roll running faster than the paper speed will apply adhesive to the back side of the flute. Both issues will cause warp because the machine can only gel the adhesive that is on the flute tip.

When adjusting for up-warp, an operator might add wrap to the single face web to correct the warp issue, but really should be lessening the wrap on the double face liner. A heat gun is very useful in making the optimal adjustments.

Sometimes increasing corrugator speed will flatten out the board because this helps bring the liner to the optimum running temperature and moisture content. Remember, the faster the corrugator runs the less adhesive you should apply to make a good bond. A moisture difference greater than 1.5% from the single face liner to the double face liner can cause warp.

## Tension Issues

End-to-end warp is usually caused by tension issues, which can include:



- Preheaters not turning
- Roll stand brakes not functioning properly
- Splicers not controlling the braking correctly on small diameter rolls
- Rolls that do not turn freely
- Web guides improperly maintained
- Excessive drag in the hotplate section

Recycled liners sometimes do not create sufficient drag on the preheater drums to turn them. When this happens, condensate accumulates in the bottom of the preheater and creates a temperature differential around the drum. You may have to adjust the wrap to obtain proper heat.

Splicers should be set up on at least a quarterly preventive maintenance program to ensure the bearings and rolls move freely and create minimal drag. Automatic splicers control the braking as the rolls get smaller. If these controls are not working correctly, added tension to the liner will cause problems. If the brakes wear down or the calipers are not working freely, they will not apply the appropriate braking resistance, which also creates tension problems.

Web guides should be cleaned and inspected weekly. When using vacuum guides, the vacuum holes can become clogged with dust, creating less vacuum and therefore less tension. In systems with a tension roll, the cover on the roll should be inspected for wear. When the covers become smooth they need to be recovered with semi-rough surface tape to add drag to the web.

Drag in the hot plates section can create tension warp. Older, worn plates are particularly prone to this problem. To avoid the cost of purchasing new hot plates, some plants install an automatic lubricating system at the mouth of the double backer. It is set up to respond to an increased amperage load on the drive motor. When the amps increase due to drag, the

system sprays lubricant on the bottom liner, which is then transferred to the hot plates, reducing drag.

## Uneven Stresses in the Paper

Twist warp may be caused by improper machine alignment. Machine alignment can be checked by tramming the individual components to each other. Web side guides should be square to the machine. As corrugator belt wear occurs, it may be necessary to adjust the bridge tracking rollers to ensure the web is in the center of the belt. Wrap arms on older preheaters can be out of alignment due to wear in the gears from years of use. The use of self-aligning wrap arm rolls may be less costly than replacing the gears or the preheater.

## Be Methodical

We'll probably never conquer warp completely, but we can reduce it so it doesn't interfere with downstream operations. A systematic analysis of moisture content, tension issues, and uneven stresses on the paper will help you produce drier, firmer, flatter board.



## Corrugator Roll Loading

by Wayne Porell

Corrugator roll loading should be checked frequently to ensure good board quality and to extend the life of the corrugator rolls. Many operators run with high roll pressure to minimize blow outs between the liner and medium, but the higher pressure may damage the medium and degrade the bond.

Because most singlefacers/modulefacers have a crowned corrugator roll, the loading pressure needs to be adjusted based on the web width. Narrower web widths require less pressure to form the flutes properly. Most machine manufacturers provide recommended settings for different web widths. For example, 60" - 75" paper might only need 50 bars (725 psi) of pressure; 76" - 86" paper might need 70 bars (1015 psi); and widths above 86" might need 85 bars (1230 psi). Refer to the operator's manual for the correct settings for your specific machine.

Running maximum corrugator roll loading on narrow web widths can fracture the medium, especially near the edges of the paper. Medium fractures are not always easily seen by the naked eye but can be more easily identified during a soak test. Fractured medium can lead to edge delamination issues at the doublebacker. Because the issue shows up at the

doublebacker, crews often fail to look for the source of the the problem in the singlefacers/modulefacers. Medium fractures can also lead to lower ECTs, poor pin test results, and zipper board because the starch can't create a strong bond to a broken flute tip. With fractured medium, the board may feel good when it comes off the machine and is still hot, but when it cools you can crack the edges of the sheet away from the medium.

Running with excess corrugator roll pressure also accelerates the grinding process on the edges of the corrugator rolls and wears the valleys of the flutes. Over time this causes the edges of the rolls to have a higher flute profile than the middle of the roll. (Some people refer to this as the roll growing on the ends.) This profile growth can lead to blow out issues at higher speeds, especially on the smaller flutes such as D, E, and even sometimes B. When the rolls wear excessively, you can see the effect on the board profile leaving the stacker—it looks like hook warp on both edges of the combined board.

To avoid these problems and prolong the life of your corrugator rolls, make sure you check the corrugator roll loading pressure frequently and adjust it as you change web widths.



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