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ADVANCED ADHESIVES REPORT

Your corrugating newsletter from Harper/Love Adhesives Corporation

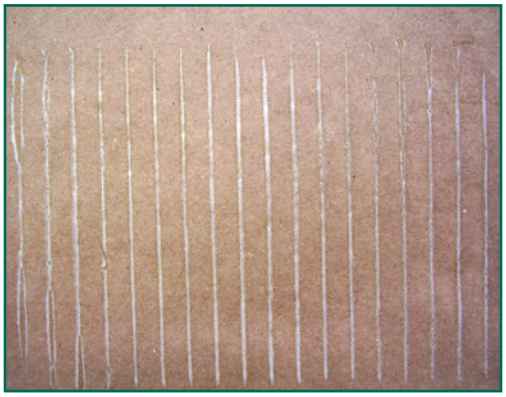
Troubleshooting delamination issues on the corrugator

By Wayne Porell

Delamination issues arise on the corrugator in many different forms. It takes careful detective work to figure out its causes and cures. Here are some of the most common.

Problems on the single facer

A white glue line (right) generally means there's not enough heat, but can also be caused by *too much* heat.



When the glue line is white and smooth to the touch, it means there either isn't enough heat at the machine or the gel temperature is too high, thus letting the starch dry but not gel. When this appears the gel temperature needs to be checked to make sure it is at the correct specification for the machine and for the speeds the plant is trying to obtain.

The steam vessels need to be checked for optimum running temperatures (generally above 360°F).

The paper needs to be checked to make sure that the correct wraps are being applied to have the liner entering the pressure roll between 180°F - 200°F.

Pressure roll adjustments that are not made correctly will result in delamination, especially when going from heavyweight liners to lighter-weight liners. If the pressure roll is not brought closer to the bottom corrugator roll when switching to lighter liners, the gap between these two rolls will not be close enough to hold the liner to the medium, resulting in a lack of heat at the glue line which results in a white smooth glue line.

When a pressure belt in used on the newer machines (in place of a pressure roll) the liner temperatures need to be between 200°F - 235°F.

If the glue line appears white, but feels rough to the touch—like sandpaper—it means too much heat is applied to the liner, causing the water to flash out of the starch before the starch can penetrate the paper fibers. Generally this will happen at paper temperatures above 220°F on pressure roll machines and 250°F on belted machines. The reason for the temperature differences between a pressure roll machine and belted machine is that the pressure roll drives the temperature up so quickly because of the nip point between the pressure roll and the flute tips. If you look closely at the flute tips, you can see where the starch actually gets burned by the pressure roll; this is not seen on the belted machine.

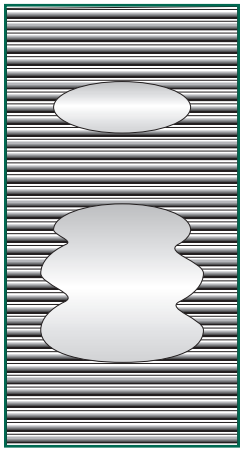
Other delamination issues at the single facer

Starch dams not set correctly can cause no starch on the flute tip of the medium. This would appear only on the edges of the sheet in the machine direction. If starch is getting wiped off the glue roll by a dirty machine, this would appear as a blister also in the machine direction with no starch on the medium or liner.

If fingers are not adjusted correctly, or if the clean-out fingers in the glue roll are not adjusted correctly, this will leave a streak, which appears as a dry streak in the machine direction.

If the starch gel temperature is running high, or the paper is cooler then it should be entering the single facer, the starch could be leaving the single facer with a green bond then could be disrupted by the incline belts or a web wheel. This would appear as a blister, but would have starch on the medium and liner.

When the single facer is started up and bags appear in the middle of the web that are the shape of a football across the machine direction (right) this indicates there is a cold roll in the single facer. These will get smaller as the machine runs and eventually disappear (until the machine is shut down again and restarted).



A spotty glue pattern is caused by the gap between the glue roll and the corrugator roll not being close enough. Some operators add starch to resolve this issue, but this can contribute to post up-warp issues after the sheets sit on the floor.

Braking problems can lead to white glue line

If worn brakes are causing you braking problems, insufficient tension on the liner or medium will result in a lack of heat, which in turn results in a white glue line. When the automatic splicer is controlling the braking system for the roll, the brakes should reduce tension automatically as

the roll gets smaller. If the splicer is not set up correctly and too much brake is released before the roll decreases in size, this will also cause a lack of tension and white glue lines can appear. If the roll chucks are not kept clean and the roll slips on them then the brakes are not allowed to operate correctly and delamination can occur.

Problems on the double backer

The same issues apply with a white glue line or zipper board on the double backer side of the sheet as with the single face. Again, the gel temperature of the starch needs to be tested to eliminate this as a cause.

The difference between the single facer and the double backer is a different type of pressure by the hold-down device that the plant is using (weight rolls, shoes, air plenums, etc.). If weight rolls, shoes or air plenums are used to apply pressure to the top corrugator belt which comes in contact with the top web and bottom liner, dirt buildup can cause the rolls to hang up and not put the correct amount of pressure to the belt, which will result in a lack of starch transfer from the flute tips to the bottom liner. This is why, when a soak test is performed, we look at the medium as well as the liner to compare the glue line thickness. This can result in low pin test and delamination issues or zipper board in either direction. The same thing can happen if the top corrugator belt is too tight because the belt is stronger then the hold down pressure and will hold up the shoes, rolls, etc.

Dirt or dried starch buildup on the side frames, where the belt lifters contact, can cause them to hang up above the hot plates. This can result in a smeared (not white) starch line, which removes the starch from the flute tip where it meets the bottom liner. This will cause delamination issues.

Other possibilities

- If dried starch builds up on the hot plates while running a narrow web, and then a wider web is introduced, the dried starch will disrupt the bond because of uneven pressure. This will appear as a very wide glue line on the liner, usually on the outside edges of the sheet.
- If the flute tips entering the double backer come in contact with the bottom liner prior to the nip point of the hot plates and then pull back apart the starch will be absorbed in the medium and when the web comes back in contact there won't be enough starch left to make the bond. This will appear as a good glue line when looking at it but will have a directional pull in both directions.
- If the glue roll at the double backer glue station is not running at the correct speed, the starch will be put on the back flank of the flute if the roll is running faster than the paper speed; if the roll is running slower than paper speed, the glue will be applied to the front flank of the flute. This will result in a directional pull of the bottom liner from the flute tips.
- If the contact shoes/rider roll over the glue roll in the glue station is not set correctly the flutes tips will not come in contact with the glue roll and will cause delamination issues. This will appear as a spotty glue pattern as it bounces on and off the glue roll.
- If the top web is not running at the same speed as the bottom liner the starch will be shifted at the glue line and cause delamination issues. This will appear as a wide glue line on the bottom liner compared to the glue line on the flute tip. This could be caused by a tension issue or the top and bottom belt running at greater than10 fpm difference.

Zipper board off the stacker

Sometimes combined sheets come off the stacker and the sheets feel good and look good and then zip apart after sitting on the floor awhile.

Generally, this happens more often with heavyweight liners than with lightweight liners. This indicates that a moisture, or green, bond is present when it leaves the corrugator. The starch dries on the flute tips and the liner surface instead of penetrating the fibers. It appears as a good line when soaked or pulled apart.

This can happen if there isn't enough pressure in the hot plate section to hold the web and bottom liner together as the starch gels. It can also occur if the paper is hard to penetrate because of wax or other coatings.

If the edges of the bottom liner are delaminated, it might be caused by dull blades on the slitter. This is especially troublesome if the starch is still in a green bond state.) Again, the starch gel temperature should be checked to make sure it is not the issue.

Be aware that bonding issues seen at the double backer are not always created there. At times the single facer can cause these bonding problems.

- Fractured flute tips at the single facer, because of excess loading on the corrugator roll
- Lack of steam to condition the medium
- Out-of-parallel corrugator rolls
- Too much pressure on the pressure roll, or the glue-roll-to-corrugator-roll gap being too tight, can cause the double backer starch to go into the flute tip instead of staying on top of the flute before the bond is made

Some of these causes can be remedied while the corrugator is running. Those are the easy ones. With others, you may not be able to avoid shutting down the machine to make the correction.

Some of these causes can be remedied while the corrugator is running. Those are the easy ones. With others, you may not be able to avoid shutting down the machine to make the correction. ■

Denise Barlow 1952 – 2008

Denise started at Harper/Love on June 4, 1991, as manager, sales administration. She was later promoted to administrative manager and was responsible for the office, customer service and IT department. For her coworkers Denise was the heart and soul of our company. She was much appreciated and will be greatly missed.

All about mixers

By Rex Woodville-Price

Most corrugating operations use some sort of starch-based adhesive to bond the liners and the medium into usable board. With few exceptions this adhesive is made in-house, using some type of mixer. Here is a brief overview of the most common types.

Primary/secondary (two tank) mixers

These were the original mixers. When the industry switched from silicate to starch adhesive, they became the standard. Many are still in service. Some operators like the control that they give in the ability to manipulate drop speed and temperature.

Primary mixers (right) use slow, counter-rotating paddles to mix the cooked portion of the adhesive. They mix a concentrated, and therefore very viscous, gel. The action is similar to that of commercial dough mixers. Since the paddles turn slowly in opposite directions, a planetary gearbox is used to drive them. They typically employ a motor of 3 HP to 5 HP.

The secondary mixer (left) uses a set of marine type propellers to mix the cooked primary portion into the slurry. These tanks are usually rectangular in shape, with vee-shaped bottoms. A shaft runs horizontally across the bottom of the vee with two or three pairs of propellers mounted to it. Usually, each pair of propellers has opposite pitch so as to force the liquid into the end walls and generate more mixing force. Typically a motor of 10 HP to 20 HP drives the shaft via a vee-belt.

The following two types of mixers are by far the most numerous and seem to be the industry's choice for replacement of older two-tank mixers. With modern electronics and load cells to weigh ingredients, these mixers can run automatically with little operator intervention.

High-shear mixers

High-shear mixers (right) use a dispersion type blade that is often called a *Cowles*® blade, but other designs are also used such as the *Hockmeyer*. Since they look like a saw blade, they are inevitably called saw type blades. This blade is generally attached directly to the shaft of a 30 HP to 50 HP motor.

Three distinct forms of mixing occur:

1. The tips of the blade physically hit the particles. This is why enough tip speed (2,500 to 5,000 feet per minute) is necessary for proper mixing and consequently enough horsepower to maintain tip speed in a dense and viscous liquid such as corrugating adhesive.
2. The particles collide with themselves in the turbulent ring that surrounds the blade tips. It is often called the zone of attrition.
3. Further away the flow becomes laminar (neat and orderly as opposed to the chaotic disorder of turbulent flow). Here the particles mix with the liquid and are either dissolved or dispersed.

All this movement causes friction between the liquid, the particles and the mixer components. This friction tends to raise the temperature of the mixture. So much heat is generated that it is possible to gel a batch if it were allowed to mix for an extended period of time.

The blade is one-third of the tank diameter and is positioned off the bottom of the tank a distance equal to its own diameter. These dimensions are important to achieve the three types of mixing mentioned above.

Adhesive mixers do not introduce much air into the mix, because of the placement of the blade. If the blade is too high it will pull in air; the rule of thumb is that there be no less liquid above the blade than below it. This is why it is a good idea to follow the manufacturer's recommendations as to minimum and maximum batch sizes.

Emulsifying Mixer

Emulsifiers use a blade (rotor) inside a metal casing with holes (stator). They work like a combination of a centrifugal pump and a guillotine. The adhesive gets sucked in the bottom of the mixing head and is sheared or milled, then forced out the openings in the sides. Depending on their design an emulsion mixer may have auxiliary agitation.

And finally, a word about agitators

Agitators are used on storage tanks to keep the adhesive, well, agitated. This ensures a more constant viscosity and also helps the TVC heat exchangers work by constantly exposing the adhesive to the coils. These devices are usually controlled by a timer, because they do not need to be on continuously. Running them all the time would be a waste of energy and might cause a drop in viscosity due to excessive shearing. Their motors are generally much smaller than mixer motors and use a marine type propeller, which rotates at much lower speeds.

Agitator mechanisms come in two flavors; vertical or horizontal. This refers to the position of the shaft in the tank. Older equipment had the shaft entering horizontally at the side near the bottom. This required some sort of seal around it (packing) and was prone to leaking if it was not maintained properly. Most modern equipment places the shaft in the vertical position so that the shaft enters the tank through the top, eliminating the need for a seal. ■

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Harper/Love Adhesives Corporation
11101 Westlake Drive
P.O. Box 410408
Charlotte, NC 28241-0408

800-438-3066 • www.harperlove.com
e-mail: salestech@harperlove.com

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Three decades of service to the corrugating industry

Sustainability

Beyond packaging: a call for environmental responsibility

Long before sustainability became an industry buzzword, we were actively exploring ways to minimize the environmental impact of our operations — and yours.

Some of our Earth-friendly innovations:

- Very low VOCs in our products
- Formaldehyde-free resins
- Products focused on bonding wax-alternative substrates, to promote their use
- Products to improve rigidity and performance of lighter basis weight liners
- Long-life, returnable totes
- Warehouse locations that minimize shipping distances
- Piggy-back rail shipments to reduce fuel consumption
- Zero-discharge plant consultation

We applaud the current emphasis on sustainability and are proud to be part of it. We welcome your questions and suggestions.