HARPERLOVE

ADVANCED ADHESIVES REPORT

YOUR CORRUGATING NEWSLETTER FROM HARPERLOVE

November 2017

Troubleshooting Starch Application

Producing flat, dry, well-bonded corrugated requires proper and consistent starch application. Achieving optimal starch application depends on the glue roll cell condition, proper gap settings, and roll alignment. If the glue roll cells aren't clean and in good condition or if the gaps between rolls aren't parallel and correct, you can expect bonding issues, warp, delamination, and excessive starch consumption.

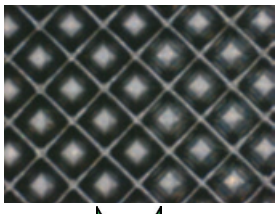
Glue Roll Condition

Glue rolls need to be clean and free of debris, such as calcium build-up or dried starch in the cells. The cells also need to be in good physical condition. Most traditional cells are only 0.009" deep, and they can be damaged from impacting the corrugating roll. Achieving an even and consistent glue pattern requires that the glue cells be consistent across the full web. Cells that are worn or damaged can cause uneven starch application, which leads to "S" warp and bonding issues across the web. As you can see below, the first picture shows good cells with sharp profiles; the second picture shows worn cells; and the third picture shows cells that have been destroyed from encountering the corrugator roll. The cells can also be damaged at the doublebacker if the contact/hold-down bar and rider roll are not set correctly and impact the glue roll. Most contact bars should be set 0.060" from the bottom of the shoes to the top of the glue roll. If the plant runs micro flute then the shoes should be set at 0.030" to 0.040".

As you can see, as the cell walls start to wear the cells become shallower. The starch will then start to film on top of the glue roll instead of filling the cells. This leads to improper and inconsistent amounts of starch being applied to the medium.

Furthermore, worn cells increase the tendency of the starch to sling off the glue roll onto the medium, which leads to post warm issues and wet board.

New glue roll viewed through a scope - cells are deep and walls are thin.



Side View

Worn glue roll viewed through a scope - cells are shallower and walls are wider.

Side View

Damaged glue roll viewed through a scope - cells are less defined and walls are wide.

Side View

Gap Settings

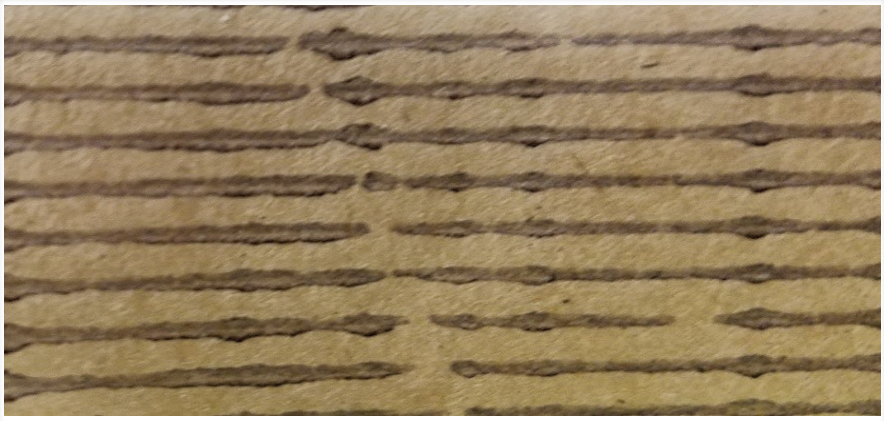
The gap between the glue roll and corrugator roll must be set correctly. If this gap is set too wide (i.e., much wider than the thickness of the medium), the operators will need to add more starch to be able to contact the medium. When this happens, the starch is more prone to sling off the roll onto the medium resulting in board quality issues. If this gap is too close it can cause fracturing of the flute tips which will result in lower pins and ECT values. The glue roll to corrugating roll gap should be changed every time the grade of medium changes.

As a glue roll wears, operators generally will change the gap settings to increase

the starch application and to prevent delamination issues from a lack of starch transfer. This is accomplished either by increasing the gap between the glue roll and metering roll or closing the gap between the glue roll and the corrugator roll. The best option is to close the gap between the glue roll and corrugator roll to avoid starch slinging.

Roll Alignment

Proper starch application requires alignment from the glue roll to the corrugator roll and from the glue roll to the metering roll. Either station out of parallel can cause issues from warp, delamination, or wet board. All these issues have a negative impact on waste and productivity. Alignment issues between the glue roll and the corrugator roll can also contribute to blow-out/fluff-out issues due to a lack of starch on one side or too much starch on the other side with insufficient heat to get it to gel. At the doublebacker, rolls that are out of parallel will lead to bonding issues either from edge delamination due to a wet edge which is disturbed by the slitter blades, or hook warp issues. On the closer side, roll misalignment can lead to zipper board issues or edge delamination since you are applying less starch.



Glue lines showing excess starch squeezing out from the flute tips or poor contact through the hot plates.

In checking the gaps, it is important that the digital readouts match the actual gap so the operators accurately know their starch gap. The digital readout should be calibrated weekly during a PM along with the roll alignment.

Heat

In addition to proper starch application, obtaining a strong bond and flat board requires the right amount of heat. When paper entering the corrugator is overheated (i.e., above 212°F) and insufficient starch is applied, the water will flash off before the starch can penetrate, resulting in zipper board. Operators will generally just add more starch in this case, but that unnecessarily increases costs—now you are using too much heat and too much starch! The correct solution is to reduce the heat.

Starch Consumption

Plants that monitor starch consumption on a shift-by-shift basis can quickly identify crews that aren't using optimal machine settings. Increased starch consumption also gives the plant a heads-up that there is a problem in the process or a problem with the machine. Operators frequently ask how much starch they should apply for specific paper grades. The answer differs from plant to plant due to differences in machine designs. Ideally, you want to apply only enough starch to stick the paper together—more is just wasted. The best practice to determine the optimal amount is to check pin values and ECT's. If pins are above 50 or so, then you are probably applying more starch than necessary unless you are running WRA or WPA. The glue lines also give a good indicator of the starch application. If the machine is properly maintained, glue lines should be 0.040" to 0.050" on lightweight liners and no more than 0.060" to 0.070" on heavyweight liners. If you are trying to achieve WPA results and wet pins, then the glue lines should be between 0.080" and 0.100".

Summary

Performing some basic process and machine checks and ensuring that you have proper and consistent starch application will help you produce flat, high-quality corrugated board. Ensure that your glue rolls are in good condition, and that the cells aren't excessively worn; check your rolls gaps and alignment; ensure your paper temperatures are correct; and monitor your starch consumption by shift to identify trends that will give you an early indication of a problem.

Wayne Porell
Senior Technical Representative
HARPERLOVE

How Much is Corrugator Speed Worth?

The May 2017 **Advanced Adhesives Report** contained an article entitled "How much is Corrugator Waste Costing You?" which explained how to calculate the cost of corrugator waste and how to value waste improvements. As a sequel to that article, we will now address the other key driver of the financial performance of a corrugator: speed.

Speed improvements on the corrugator are valuable to a box plant because they increase the amount of sellable product that a plant can produce in any given amount of time. This translates into either additional volume for the plant or reduced production costs, depending on specific market and production situation in the plant.

To calculate the financial impact of speed improvements:

1. Determine the hourly value of corrugator time using one of the methods below. The appropriate method will depend on the specific situation in the plant (running overtime to meet demand, opportunities to sell additional product, etc.).
   a. The plant's hourly machine burden rate for the corrugator.
   b. The total wage rate for all the corrugator employees on one shift multiplied by 1.8. This is based on the assumption that incremental production efficiency will reduce overtime, overtime is paid at time-and-a-half, and employee benefits are approximately 20% of compensation.
   c. The profit contribution from an hour of corrugator production which would be approximately the average tons produced off the corrugator per hour multiplied by the difference between the average selling price ($/ton) and the average containerboard price ($/ton). This is based on the assumption that incremental production efficiency will increase the plant's output and the plant can sell the incremental production.

2. Determine the number of hours the corrugator currently runs per year.

3. Multiply the number of hours from #2 above by the baseline speed of the corrugator and divide by the new speed of the corrugator. This will be the number of hours the corrugator will need to run at the new speed to produce the same volume it did at the old speed.

4. Subtract the number of hours calculated in #3 above from the number of hours in #2 above. The difference is the number of corrugator hours saved by running faster.

5. Multiply the number of hours from #4 above by the hourly value of corrugator time from #1 above. This yields the value of the speed increase.

Example Calculation:

1. **$500 per corrugator hour**
2. **250 production days per year X 24 run hours per day = 6,000 corrugator hours per year**
3. **6,000 hours X 800 feet per minute ÷ 850 feet per minute = 5647 hours**
4. **6,000 hours - 5,647 hours = 353 hours**
5. **353 hours per year x $500 per hour = $177k per year improvement**

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