ADVANCED ADHESIVES REPORT

JANUARY 2000

Your corrugating adhesives newsletter from Harper/Love Adhesives Corporation

Measuring starch consumption: Why. How. What to expect.

It's easy, and very much worth doing.

By Bill Gerard

I'm often asked about the value of calculating starch consumption, the best methods for doing it, and what levels of consumption are attainable.

The why is simple

Anything you can do to reduce starch consumption is worthwhile, because lower cost means greater profit. But you can't make meaningful decisions about starch management without good information. By measuring starch consumption continuously you create historical information against which you can compare current operations. We recommend you measure and record starch consumption on every shift.

What to expect

We often hear that some corrugators have achieved starch consumption rates as low as 2 pounds per MSF. Does that mean this is attainable in every plant? No, it doesn't. Neither does it mean you are wasting starch or running wet board if your numbers are higher.

Several things affect starch consumption. One important factor is the basis weight of the board being run. Generally speaking, light basis-weight board requires less starch than heavier products. Wet-strength adhesives use more starch than those without wet-strength components. Also, plants that pay close attention to the mechanics of starch application will achieve lower rates than those with a more relaxed approach.

A well-managed adhesive system should experience starch application rates similar to these, which reflect actual experience on corrugators throughout the country.

BASIS WEIGHT lbs/MSF	STARCH RATE lbs/MSF
Below 100	1.8 to 2.0
100 to 120	1.9 to 2.3
120 to 140	2.2 to 2.6
140 to 160	2.5 to 3.0
160 and above	2.8 to 3.2

How to measure starch consumption

To measure the amount of starch used on your corrugator, you'll need to measure starch in storage at the beginning and end of each shift, and record how much starch was made during the shift. Multiply gallons of starch by dry pounds (including starch, caustic, and borax) per gallon, and the answer is total pounds used.

EXAMPLE

Beginning gallons in storage*	1,000
Gallons made during shift	+ 1,330
Total starch available	2,330
Ending gallons in storage	- 1,200
Total gallons used	**1,130**
Dry lbs. per gallon**	x 2.18
Total dry pounds used during shift	**2,463**

**The typical 2,000-gallon storage tank holds about 24 gallons of starch per lineal inch of side wall. You measure the tank's contents with a measuring stick. Refer to your tank's volume chart. You can also calculate volume from the tank's measurements. If you need help with this, ask for our Technical Information Bulletin, "Volume calculations for tanks and vessels."*

***In this example, we have used a value of 2.18 dry pounds per gallon. Your formula might be different.*

In addition to the starch measurement, it is necessary to calculate the total square footage of board run on the corrugator, including side trim and any bad sheets produced. If this gross amount of square footage is not used, the starch application rate for the net square footage will be artificially high. The square footage is calculated by multiplying width times length for every order produced during the shift.

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Starch consumption, continued

C-Flute Equivalent - adjusting for different flute sizes

Many plants take this calculation one step further and convert all the board to "C-Flute Equivalent" measurement. This technique provides a way to "compare apples to oranges" and reduce all production to a single, easy-to-compare measurement.

To arrive at a C-Flute Equivalent, multiply other flute-size production by the following factors:

A flute	0.86
C flute	1.00
B flute	1.20
B/C flute	2.20
A/C flute	1.86

Here's an example. This would be a very unusual plant, but the values we've used help demonstrate the effect of using a C-Flute Equivalent calculation.

FLUTE SIZE	ACTUAL PRODUCTION	FACTOR	C-FLUTE EQUIV. PRODUCTION
A	200,000	0.86	172,000
C	200,000	1.00	200,000
B	200,000	1.20	240,000
B/C	200,000	2.20	440,000
TOTAL	**800 MSF**	**=**	**1,052 MSF**

The last step of our process is to divide the dry pounds of product consumed by the square footage run. Using the examples above, the calculation looks like this:

	ACTUAL	C-FLUTE EQUIV.
POUNDS USED	2,463	2,463
÷ MSF PRODUCED	800	1,052
= POUNDS PER MSF	**3.08**	**2.34**

It's easy, and it's worth doing

As you monitor your starch usage on a per-shift basis, and compare glue-line soak values, you will accumulate the information you need to reduce starch consumption to the lowest possible rate for the products you run. You'll save money. You'll also improve warp control and board firmness, which will benefit your downstream operations as well.

In this discussion, we have focused on the use and application of domestic starch adhesive. If you are running wet-strength adhesive, you would conduct your measurements in the same manner. If your wet-strength adhesive is run from a separate tank, you can isolate your starch usage on wet-strength board. (Expect your wet-strength consumption figures to be higher than domestic starch.)

On the same corrugator, all shifts should be capable of achieving similar starch consumption figures. But because different corrugators have different characteristics, results can vary from plant to plant.

We have developed a simple starch consumption work sheet you might find helpful. To get a copy, and for answers to any technical questions, contact your Harper/Love representative or call us directly.

Customers agree: buckets are better than bags

Harper/Love liquid product shipments have been on a sharp upward trend since 1994, and have exceeded dry-product shipments for the past 3 years. In 1999, they accounted for 62 percent of all product shipped.

The reasons aren't hard to understand. Liquid performance products offer many benefits corrugators find hard to ignore:

- Liquid products are safer to use. No bags to cut. No lifting. No dust.
- Returnable totes. No throwaway bags. No drum problems.
- Easy to use, even in a manual kitchen.
- Easier, more economical automation.
- Reduced labor, more efficient starch making.
- Improved stability of viscosity and gel point.
- Better film-forming for lower application levels.
- Firmer and drier corrugated sheets.

Meet Sue Biggers

The friendly person behind the friendly voice

Harper/Love customers know Sue Biggers as the voice of service. The eight-year veteran, eager-to-please customer service coordinator handles sales orders for customers in seven out of ten HLA sales territories, plus Canada. As if that doesn't keep her busy enough, she also supports the sales and technical staff in their work. Sue lives in Fort Mill, South Carolina, with husband Ronnie, and spends as much time as possible with her 4-month-

New representative in California

Todd Nelson has joined the Harper/Love technical service team. He will serve customers in southern California and western Arizona. Todd offers HLA customers the benefit of more than 23 years in the corrugating industry, including 17 years as a corrugating supervisor. He lives in Corona, California, with wife Brenda, son Taylor, and daughter

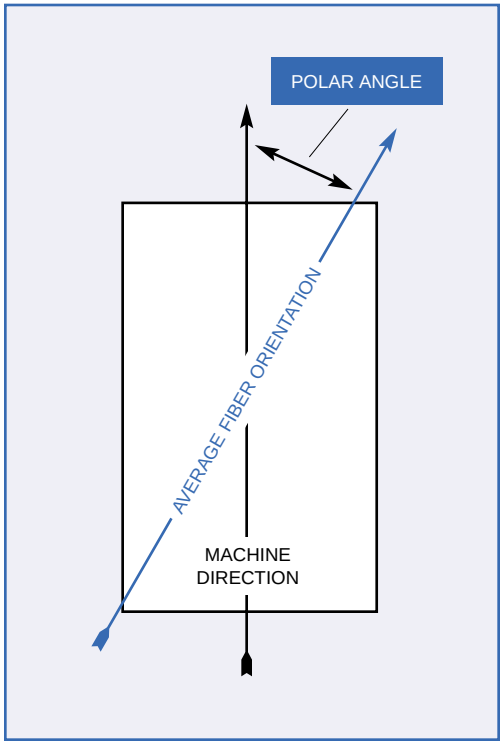
General Manager Bill Kahn, left, and TSR Todd Nelson check out "the tools of the trade."

Troubleshooting twist warp

Ask for our latest Technical Information Bulletin (TIB) to explore the causes and cures for this perplexing problem.

Corrugating consultant Bill Nikkel has added to our library of Technical Information Bulletins with an explanation of the common causes of twist warp, how to determine what's going on, and ways to fix it.

Work done by the Institute of Paper Science and Technology (PST) some years ago showed that when polar angles in the single-face and double-face liners do not match, twist warp can be expected if the mismatch in these angles exceeds 5 degrees. Polar angle can be visualized as the difference between the machine direction of the paper, and the average orientation of fibers in the paper.



In the bulletin, Bill explains that consistent twist warp indicates a machine condition that needs attention. Twist warp that comes and goes, and changes shape, probably is caused by a paper condition.

There are various combinations of polar angle mismatch, and different ways to correct for it. To get the whole story, ask your Harper/Love representative for the TIB, *Twist warp and polar angles.*

Our growing TIB library includes these titles:

1. Volume calculations for tanks and vessels
2. Calculating shaft speeds for secondary mixer
3. Determination of natural gel point of starch
4. Calculating percent solids of starch adhesive
5. The importance of carrier solids in starch adhesive
6. Harlocide™ and microbial resistance
7. Board testing – why do it?
8. Considerations in making wet-strength board
9. What level of waterproof?
10. Formulating in a closed-loop system
11. Understanding wet strength: What are MRA, WRA, and WPA?
12. Working with high ring crush liners
13. Removing calcium build-up from glue rolls
14. Using wastewater to formulate starch adhesives
15. Twist warp and polar angles

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LiquiBond®

It's about time!
And money!
And quality!

LiquiBond adhesive performance enhancer dramatically improves quantity and quality of corrugator output. Users report up to 30 percent faster running speeds, and drier, firmer board. LiquiBond is conveniently post-added to the starch formula. Automation is easier and more economical than with powdered products. It can be used in manual starch systems, as well. Available in convenient 275-gallon returnable totes.