



OCTOBER 1999

## Understanding wet strength: What are MRA, WRA, and WPA?

*Customize your adhesive formula to deliver the wet strength you need.*

To determine the “wet strength” needs of a corrugated box plant, we must first define the level of “wet strength” needed. Generally, our industry has accepted three levels of “wet strength” adhesive.

1. *Moisture Resistant (MRA)* – used for the lightest possible applications.
2. *Water Resistant (WRA)* – medium level of performance.
3. *Waterproof (WPA)* – highest level of performance.

For all practical purposes, we know of no box plants running all three levels of “wet strength” as well as domestic adhesive, but for clarification, we will attempt to identify the key characteristics of each type of “wet strength” adhesive and when it would be used. We will also discuss proper test methods to determine the level of water resistance of a particular box.

### 1. Moisture Resistant Adhesive (MRA)

MRA most closely resembles domestic adhesive in formulation and application. A typical MRA starch will contain approximately .5% to 1% liquid resin relative to the liquid volume of the batch.

This level of resin would typically be used in a lightweight board combination where no exposure to increased humidity may occur.

No TAPPI test method is recognized to evaluate this level of “wet strength.” Generally, a one-hour soak test using a similar procedure to TAPPI method T-812 will be sufficient. If the board does not float apart, the box meets the minimum level of moisture resistance.

Here are sample starch formulae for MRA, WRA, and WPA adhesive, assuming a typical 650- to 750-gallon batch\*.

**MRA:** 4 to 5 gallons of wet strength resin. Application is same as domestic.

**WRA:** 8 to 10 gallons of wet strength resin. Application is same as domestic.

**WPA:** 10 to 15 gallons of wet strength resin. Application is 50 % more than domestic. Loads are stack cured for a minimum of 4 hours.

*\*In a typical 300-gallon batch, all quantities are halved.*

### 2. Water Resistant Adhesive (WRA)

WRA probably has the widest range of applications due to the fact that most corrugated box plants only have the ability to make one type of “wet strength” adhesive. Water Resistant Adhesive will have between 1% and 1-1/2% resin relative to the liquid volume of the batch. This adhesive formula can be used on lightweight boxes using normal or domestic starch settings. When running heavyweight boards, 250-pound test and above with greater end use demand, it is necessary to open the glue gap settings, at least an additional .004”, especially at the singlefacer. Also, a minimum stack cure time of 4 hours is essential for optimum results.

The typical test method for WRA starch is TAPPI T-812, commonly called the 24-Hour Soak Test.

An additional test which is suitable for heavier test board (over 250-pound C Flute) is the wet pin adhesion test. This test procedure is described in TAPPI T-821, and a generally accepted norm is that the wet pin adhesion value should be at least 4 pounds per 2 lineal feet of glue line.

*(wet strength, continued)*

*(next page, please)*

### 3. Waterproof Adhesive (WPA)

WPA is the highest level of “wet strength.” This in itself is a misnomer in that all starch is water soluble. This type of adhesive would typically be used in the most demanding applications. In addition to using 1.5% to 2% “wet strength” resin in relation to the liquid volume of the batch, it is essential that additional starch be applied to the board. It must be allowed to cure in its original stack for a minimum of 4 hours before processing.

The TAPPI test method is the same as moisture resistant starch, but typically, the wet-pin

adhesive values will be 8 to 12 wet pins per 2 lineal feet.

#### References

TAPPI Technical Information Sheets:

- T-812 *Ply Separation of Solid and Corrugated Fiberboard (wet)*
- T-821 *Pin Adhesion of Corrugated Board by Selective Separation*



#### Guidelines

1. Use fresh starch with at least a 25% batch solids for MRA and 28% solids for WRA and WPA.
2. Use freshly resinated adhesive, not more than 6 hours old.
3. Apply the same glue line in light applications and approximately 50% more for 250 - pound test and above.
4. Allow the board to cure in its original stack for a minimum of 4 hours. Twenty-four hours cure time is recommended for wax impregnated board.

## New faces on the Harper/Love team

**Anthony Coleman** and **Craig George** join our technical staff with more than 40 years of combined corrugating experience. Each has worked as an operator

and supervisor, and has been deeply involved in process improvement. Craig will be based in the Orlando area to support a growing customer base in the southeast. Anthony will work out of Charlotte.

**Harold L. Fortney** will work exclusively with Harper/Love as a consultant. He specializes in areas such as project planning and management, waste management systems, labor standards development, and more. During his 45-year career, Mr. Fortney has worked as senior industrial engineer, general manager, director of corporate services, vice president/chief operating officer, and plant manager. He has been an active leader in many trade associations, including TAPPI, which he joined in 1970. Mr. Fortney lives in Belle Plaine, Kansas.



FROM LEFT: Anthony Coleman, Craig George, Harold Fortney.

## See us at TAPPI

*We'll be in Booth 235 at the Hyatt Regency in Chicago to meet, greet, and mingle. Please drop by to say hello.*

Also, Pete Snyder will offer a great training opportunity in a workshop presentation entitled *Starch Adhesive Management*. The program, which focuses on the bonding process on the corrugator, will be the central theme of the Production Committee Workshop. The material has been presented to numerous industry groups since 1990 and has been updated recently with computer-generated slides and a new video production entitled, *The Secret Life of Starch*.



*Pete Snyder's 2-hour starch management program is scheduled for 9:30 a.m. on Wednesday, November 3.*

### Stein-Hall vs. Love cup conversion.

The measurement of viscosity is a critical quality-control check.

Most people use a Love cup or a Stein-Hall cup, measuring the flow in seconds. The Love cup flows faster, because it has a larger aperture.

Assuming a constant temperature, how much faster the Love cup flows depends on viscosity. For example, at 100° F, 7 seconds Love = about 15 seconds S.H. but 80 seconds Love = about 117 seconds S.H. It is not a straight-line curve.

We've developed a chart that compares Love cup times to S.H. cup times across a wide range of viscosity.

For a copy of the chart, and more information about measuring viscosity, contact your Harper/Love representative.

### New representative in Mexico

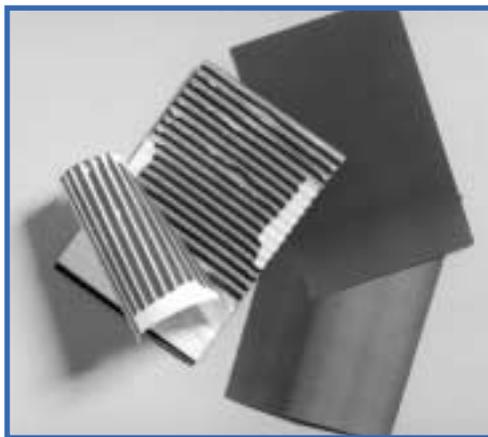
Harper/Love welcomes ALHU International, Inc., of El Paso, Texas, to its growing list of international representatives.

The 18-year-old firm has established contacts with 95% of all corrugating plants in Mexico, providing auditing, consulting, installation and distribution of corrugating equipment, spare parts, consumables, prime materials, and related services.

ALHU has field offices in Tizayuca, Hidalgo, Mexico.

## Don't throw away that preprint!

What do you do with leftover preprint? If you're throwing it away or recycling it, you may be missing an opportunity to save some money.



*Fiber tearout on test sample (left) demonstrates strong adhesive penetration in spite of heavy ink coverage.*

The economical solution is to run it print-side in on the double backer. Until now, that has been tough because the inks and varnishes inhibited penetration making a good bond difficult to achieve.

That's no longer a problem. An adhesive formula that uses a high-solids carrier, plus LiquiBond™ and our XM-5 penetrant now makes it possible to get a good, fast, penetrating bond on printed and varnished surfaces. XM-5 penetrant reduces surface tension and enhances starch adhesive penetration. Its use promotes consistent performance and precise quality control. It is an easy-to-use liquid, available in drums and buckets.

- And more
- New agent in Mexico
- New faces on the HLA team
- Starch management training
- Use that leftover preprint
- Understanding wet strength

## IN THIS ISSUE

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*Leaders in the science of  
making good adhesives better™*

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Your corrugating adhesives newsletter  
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## REPORT

# ADVANCED ADHESIVES

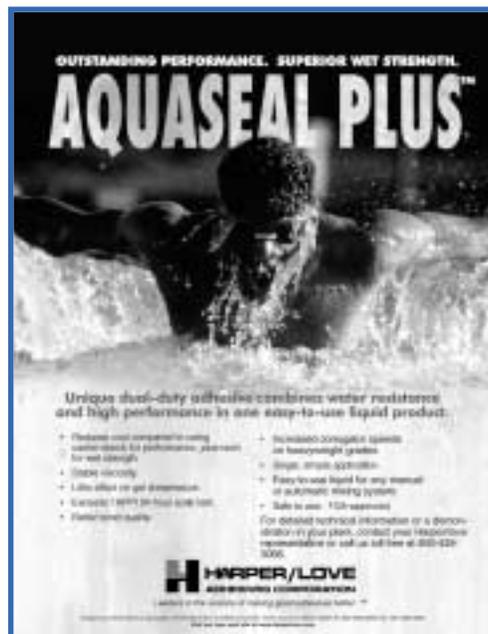


## Aquaseal Plus™

# Outstanding performance. Superior wet strength.

This unique product combines water resistance and high performance in one easy-to-use liquid product.

- Reduces cost compared to using carrier-starch for performance, plus resin for wet strength
- Stable viscosity
- Little effect on gel temperature
- Exceeds TAPPI 24-hour soak test
- Better bond quality



- Increased corrugator speeds on heavyweight grades
- Single, simple application
- Easy-to-use liquid for any manual or automatic mixing system
- Safe to use. FDA approved.

For detailed technical information or a demonstration in your plant, contact your Harper/Love representative or call us toll free at **800-438-3066**.