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ADVANCED ADHESIVES REPORT

Your corrugating newsletter from Harper/Love Adhesives Corporation

Dual arch process considerations

By Joe Giovanni

Running dual arch successfully requires attention to a few details on the machine. Here are some things to address as you prepare your machine to produce good quality dual arch.

Adhesive selection

There are two types of adhesive used for dual arch: cold set (PVA) and starch. Starch adhesive is an attractive alternative to PVA; it produces good bond and strength at minimal cost. PVA adhesive produces a good bond but it costs more and is not as forgiving as starch for runability. Starch adhesive is convenient to run because the starch kitchen is already making adhesive for the corrugator, and only minor changes are needed for the formula to work as a dual arch adhesive (see sample formula).

With a PVA, you must set up some type of delivery system to feed the glue pan. Most plants running PVA feed it directly from the tote to the glue pan. To do this, you must have plenty of room at the machine to store the tote while feeding the glue pan running dual arch. With a starch adhesive, you simply run a feed and a return line to the dual arch glue pan and you're ready to run. Take care when using PVA adhesives; many are borax intolerant and will cause a cleanup mess if allowed accidentally to contact starch adhesive.

Splicing options

When running two mediums for dual arch, you must also consider your splicing options. Generally, most plants use the top liner splicer from another single facer, and send the medium back toward the dual arch glue unit to coat the top medium. This way you can still maintain a continuous run without shutting down the corrugator when it's time to start a new roll of medium.

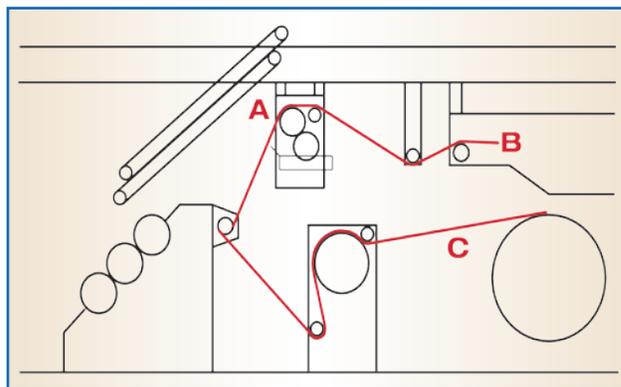


Illustration: typical dual arch thread-up. The dual arch glue unit (A) usually hangs below the bridge at the exit of the medium splicer closest to the machine. (B) shows path of medium from roll farthest from single facer. (C) shows the path of medium from roll closest to the single facer.

Heat transfer

One of the most common problems when laminating two mediums together prior to the corrugating roll nip point is insufficient transfer of heat. By heating the top medium prior to the dual arch glue unit we can achieve a much faster bond prior to going into the machine. To accomplish this, some plants install a small preheater (photo, right) that also hangs from the bridge prior to the dual arch machine.



Adhesive application

Whether you're running PVA or starch as your adhesive, application is the key. As on the corrugator, you want to run the dual arch adhesive with minimal application and still create a solid bond. When the top medium has too much adhesive application it will bleed through the lower medium, which transfers adhesive to the corrugating rolls. That can result in corrugating roll wrapups. The dual arch glue unit has several different ways to adjust application. Roll speed and adjustable gap between the rolls are the main adjustments. When the gap is opened, the bead that is applied to the medium gains in height. When the roll gap is closed it reduces the size of the bead, which reduces application. The stops on this roll must also be set correctly so reduced application can be achieved. Roll speed also controls application; when the roll is slowed down it minimizes application to the transfer roll. The faster the roll speed, the heavier the transfer to the applicator rolls.

Web tension

Other issues include tension control on the top medium. On dual arch units, the applicator roll that transfers adhesive to the medium is paper driven and is therefore affected by

Application equipment

To make dual arch board, we need to bond two mediums together and therefore need a way to apply adhesive to one of them. This requires one extra piece of equipment, an applicator, that is not part of a typical single facer.



There are several ways to apply the adhesive, from a homemade blade coater to a dedicated applicator such as the Profero. While any of these methods will work, they do vary in their effectiveness and efficiency. As we increase run speeds, adhesive control and application rate become a limiting factor. For larger production volumes, managing consumption will have an impact on profit margins. The choice of equipment will be affected by these considerations.

Let's look at a few options

- **Blade Coater:** This is the cheapest and simplest method, but may not be able to dose the adhesive effectively at lower application rates.
- **Rod Coater:** This system has better control at lower rates but may be difficult to clean once PVA is used in it.
- **Medium Wax Impregnator:** Some plants already have one of these in house, which can be used to run dual arch. Conveniently, it is already adapted to having medium run through it.
- **Dedicated Applicator:** Specialized dual arch applicators have several advantages when it comes to adhesive control and typically allow fine adjustment over a wide range of operation. Some like the Profero, apply adhesive in lines (as opposed to full coverage) which provides even more control and economy.

splicer tension. While the corrugator is down for thread-up, the roll is driven by a motor at a slow idle speed to prevent the adhesive from drying on its surface. Once the machine is started up, a clutch on the motor disengages and the roll becomes driven by paper tension. If the top medium splicer tension is too low, the paper will not have enough drag to turn the roll, resulting in poor application. Splicer tension should be at least 150 psi on the tension gauge.

Dams and wipers

A key factor is the use of brass glue dams and wipers. Similar to a single facer, these wipers must be set to keep adhesive off of the edge of the medium. When glue starts to bleed off the edges, it will cause an edge blister due to grabbing on the corrugating rolls as the web exits out of the pressure roll nip. These wipers must be set at a minimum of 1/4 inch from the edge of the paper to avoid any pickup or bleed over.

Add a break detector

One worthwhile addition to a single facer used to run dual arch is the installation of web break detector. This is usually a simple limit switch touching the paper that shuts the machine down if the web breaks. This is particularly important using PVA since getting it on the hot corrugating rolls makes for a tedious cleanup.

Running dual arch is not that different from making heavy single-wall board, following good manufacturing practices will ensure your success.



John Kohl, technical director for Harper Love Adhesives, died suddenly on October 28, 2013. He was 54. John had been with Harper Love for 17 years. He was very active in TAPPI and was currently serving as an elected member of the Corrugated Packaging Council of TAPPI. He served as Chairman of that organization's Fiberboard Shipping Container Testing

Committee (FISCOTEC). He was a frequent presenter of technical papers involving both wastewater treatment as well as starch adhesive topics. He also presented at numerous TAPPI and AICC training sessions.

Prior to joining Harper Love, John was production manager in the cutting die industry for both Container Graphics and earlier for Dynamic Dies.

He was a valuable resource for the Harper Love staff and its customers; widely respected for his technical knowledge and professionalism. He will be greatly missed.

John is survived by his wife Patty and daughters Kathryn and Kristine.

The case for starch adhesive in dual arch board

It's less expensive, more convenient, and runs faster than PVA

By Rex Woodville-Price

What is dual arch board?

Dual arch is the name given to single-wall board made using two mediums. One medium has adhesive applied to it just before it enters the single facer. The two mediums are bonded together as they are formed into flutes.

Why dual arch?

Since dual arch board uses only two liners compared to three for double-wall board, it costs less. Although it cannot actually replace double wall, dual arch can be a suitable substitute for certain applications.

There are other considerations: when the medium is formed in the corrugating labyrinth, the medium paper fibers are put under significant stress. If we consider that the medium is being forced to bend almost 180 degrees in a very small distance as it forms the flute profile, we can imagine the forces at work and why a thicker medium has higher stress. Two thinner mediums, of the same combined caliper as one thicker one, will form better because they can move relative to each other and thus have less chance of fracturing the flutes or tearing the fibers. The paper fiber in the two thinner mediums would be aligned in a more orderly pattern and would lie more parallel to the surface of the sheet in the machine direction. They would thus be better able to withstand these tensile forces since most would act along their length, where they are strongest.

Advantages of dual arch

Dual arch has some characteristics that can be exploited for special cases.

- Being a single-wall board, it takes up less space than double wall, so more of the space allotted for transportation can be filled with product and less with packaging.
- Dual arch has superior flat crush value. In any board, flat crush strength comes from the fluted medium. It is well known that double wall has very low resistance to flat crush since the flutes that make it up (typically B & C) do not line up and will actually deflect each other. Dual arch construction doesn't have this problem.

Limitations of dual arch

Dual arch generally runs slower than single wall, but since it can replace double wall, its production speed is offset by this since it can run at speeds comparable to double wall. Running three papers continuously on one single facer will require three splicers. It is often possible to use one of the other splicers on the machine, by adding a few strategically placed idler rolls. You will need a dual arch adhesive applicator.

Why starch adhesive instead of PVA?

Until recently, polyvinyl acetate glue (PVA) has been the default adhesive for dual arch construction. Presumably, it was perceived to offer wet-strength benefits. Our tests have demonstrated that modern wet-strength starch formulations perform quite well in this application, and eliminate the disadvantages of PVA.

There are other compelling reasons to prefer a starch-based adhesive over PVA:

- **Faster run speeds.** When using the proper additive combination, it is possible to run faster with starch than with PVA.
- **Simpler adhesive inventory.** Since dual arch tends to be a niche market, it is often difficult to predict production volumes. This makes it difficult to always have PVA in stock, keeping in mind that it has a specific shelf life. We must also clarify that this PVA is not the same as is used for glue lap adhesive. Using the same starch adhesive you are already using on the corrugator (you would change only the additives) is convenient, plus any leftover can be used up in the corrugator.
- **Easier to cleanup.** Compared to PVA, starch adhesive is much easier to clean up because it is less sticky and is more soluble in water. When PVA dries it is very difficult to remove; it is possible to ruin a dual arch applicator through inadequate cleaning.
- **Insurance.** If the bottom medium were ever to break out, the corrugating roll could be exposed to the dual arch adhesive. It will be much easier to clean up the mess if the adhesive being used is starch rather than PVA.

Dual arch board may be a way for you to offer heavier-duty boxes at lower cost for certain customer applications. If you're already running dual arch with PVA, let us show you how the proper starch formulation can help you run faster at lower cost. Your Harper/Love representative can help you explore your options and sort out the technical issues.

Here is a formula designed for running dual arch. It has characteristics that will allow it to run well on the corrugator; it can even be mixed with your existing corrugating adhesive. This makes it very convenient to use the leftovers from a dual arch run by just pumping it into your storage tank.

Primary water	900 lbs
Primary starch	95 lbs
Primary caustic (50%)	32 lbs
Borax (5 mol)	10 lbs
Secondary water	1080 lbs
Secondary starch	680 lbs
Multibond	70 lbs
Total weight	2867 lbs
Batch volume	315 gal
Solids (starch only)	27%
Dry lbs per gal	2.46

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

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

Leaders in the science
of making
good adhesives better™



First choice of our industry's fastest corrugators

MultiBond™

Recommended for dual arch applications

MultiBond™ is a unique, fifth-generation performance enhancer. It provides higher speeds and improved bond on all grades of paper, including heavyweight, double wall, triple wall, dual arch, and hard-to-penetrate substrates.

Because it takes less to get superior results, MultiBond is batch cost neutral, which means you pay no more to run with the best, and give up nothing in the Harper/Love service you've learned to rely on.

To explore the technical and cost benefits MultiBond can provide your operation, contact your Harper/Love representative or call us toll free at 800-438-3066.

Scan this QR code on your smart phone to view the MultiBond technical data sheet

