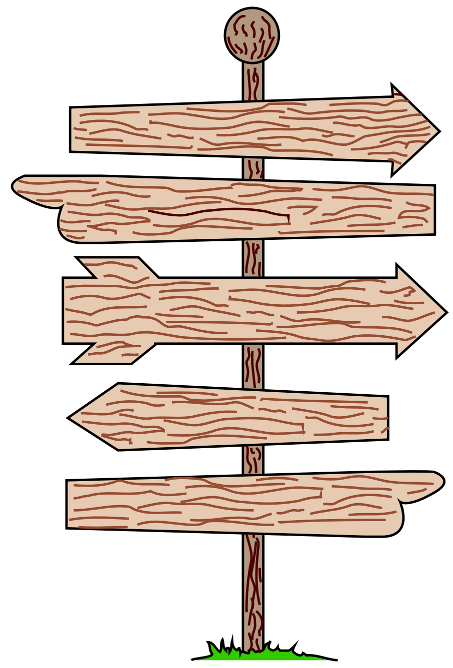
trends

published by Nordson Corporation for the nonwovens industry

August 1998 Vol. 10, No. 1



Which Way to Spray?

When considering hot melt adhesive spray for your disposable-product applications, how do you choose from the many technologies available? Should you use spirals or other types of adhesive fibers? Or neither? What type of hot melt adhesive spray technology provides the best performance? Are smaller adhesive fibers and more points of contact always better for disposable-product applications?

Once you've considered all the questions, where do you go for the answers?

Here's where it can get tricky.

For example, if you are interested in purchasing a computer and you go to a store that sells only laptop computers, it's safe to assume that the salesperson will recommend a laptop solution, regardless of what is really best for you.

Obviously, the same thing will happen in the hot melt equipment industry.

If you take your application questions to a company that primarily sells a single solution, they will recommend that solution to you.

The key to successfully choosing a hot melt spray application technology is to understand all of the issues and all of your options so that you can make the most informed decision possible. This involves a basic knowledge of the performance characteristics of each type of hot melt adhesive spray process and how these characteristics affect end-product quality and performance.

Let's look at the issues.

Your goal is to make the desired product at the lowest possible cost. To help achieve this goal, you want to apply the lowest quantity of adhesive that will satisfactorily bond your substrates and provide the product performance and quality demanded by your customers, correct? In that case, optimizing add-on weight and performance means choosing from among all of the available technologies, depending on your application parameters.

> ***Control Weave uses a unique nozzle design to uniformly apply fibers across a substrate.***

Now, let's look at the options.

For diaper- and napkin-core applications, the data clearly shows that a medium-sized fiber, such as that produced by Control Coat® technology, provides the greatest enhancement of fluid acquisition. Smaller fibers tend to inhibit flow through the pad, while larger fibers fail to allow the intimate contact that is critical to effective fluid transfer. Control Coat is also best if you are seeking a non-contact method of applying a complete coating. Examples include frontal tape on a baby diaper or positioning adhesive on a sanitary napkin.

For construction applications, larger fibers provide better performance at lower add-on rates. Thus, hot melt spiral applicators, like the Controlled Fiberization® process, are the best and most economical choice for these applications. New developments, like high-frequency spiral nozzles, have enabled this technology to keep pace with increases in machine speed and other changes in performance requirements.

Applications such as clothlike backsheet require a low add-on, cooled application of small fibers. For this type of application, fibers applied by the new Nordson Control Weave™ process meet the application requirements while minimizing adhesive cost.

Control Weave, introduced at the IDEA '98 show and described in detail in this issue of trends, uses a unique nozzle design to uniformly apply fibers across the substrate. A wide operating range is available, enabling you to 'choose your fiber size' based on your specific application and performance require-

Which Way to Spray?, continued on page 2...

CONTENTS

Which Way to Spray?, continued from page 1...

ments. Nordson has applied for a patent for this exciting new technology.

To decide which hot melt adhesive spray technology is best for your application, see the comparison chart on page 4, which defines the basic operating parameters of each of these three technologies.

Know the alternatives, know their capabilities, and rely on a full-service partner to work with you to define the technology and operating conditions that best improve your productivity and your profits.

Beware of single-solution sellers who can't offer you a full range of production-proven technologies.

And nurture relationships with suppliers like Nordson, who invest in basic technology research and development and who use this knowledge to keep you at the leading edge of your industry.

Control Weave™ Advances Small-Fiber Spray Technology

Test results show the advantages of Control Weave technology!

Manufacturers of disposable products have successfully used hot melt adhesive spray technologies for nearly 15 years. The most recent trend has been toward small-fiber technology -- adhesive fibers that are less than 50 microns in diameter. While meltblown technology has been adapted for this application, it still has many draw backs that have prevented its widespread use.

Nordson, however, has found a solution for small-fiber applications. The recently developed Control Weave process -- a new, more refined small-fiber application technology -- overcomes many of the limitations of the meltblown process.

In adapting meltblown technology to hot melt adhesive applications, some refinements were made. However, there are still many shortcomings:

- The meltblown process has a very narrow range of operation in terms of fiber sizes. It's clearly best suited for creating small fibers, which have relatively low functionality in disposable-product applications.
- The pattern quality created by the meltblown process is acceptable only at very high airflows.
- The large number of nozzles used in the meltblown process greatly reduces robustness, and the process is vulnerable to clogging and to large flow variations between nozzles.
- Edge-control definition is limited, both at the sides and at the beginning and end of intermittent patterns.
- Overspray is still a problem, mainly the result of the large number of small fibers created by the meltblown process.

With all of the observed limitations of meltblowing, Nordson set out to find a better solution for creating and applying small fibers.

Small, uniform and controlled patterns. Consistent with other Nordson spray technologies, one of the key characteristics Nordson sought when developing the Control Weave process was control -- the ability to restrain the drawdown process of the adhesive and the subsequent placement of fibers on the substrate. The goal was to create a process that was very robust and provided a wide range of capability and functionality.

The Control Weave process achieved these objectives.

For example, meltblowing utilizes a large number of closely spaced polymer outlets with two continuous slits of air positioned parallel to and on opposite sides (machine direction) of the polymer outlets. Control Weave technology, on the other hand, uses a small number of more widely spaced nozzles with two air holes on either side (cross machine) of each polymer outlet (**See Figure 1**). The result is a small fiber pattern that is more controlled and more uniform than meltblown patterns. Additionally, Control Weave uses significantly less air to create the fibers (**See Figure 2**).

At all conditions tested, fiber samples produced with the Control Weave process are of consistent size, and they are uniformly distributed. This results in highly uniform and consistent patterns.

Shot-free samples. Another advancement of the Control Weave technology is the virtual elimination of shot, or adhesive globules.

With meltblowing, it is very difficult to produce patterns of acceptable quality, particularly with larger fibers. The presence of shot or adhesive globules is very noticeable in most meltblown patterns. Shot size was very large in the low airflow settings, and it decreased as airflow was increased. It was only at the highest airflows that the globule size was reduced to levels that would not burn through or deform a sensitive substrate.

In contrast, virtually no shot was detected with the Control Weave process, regardless of test conditions.

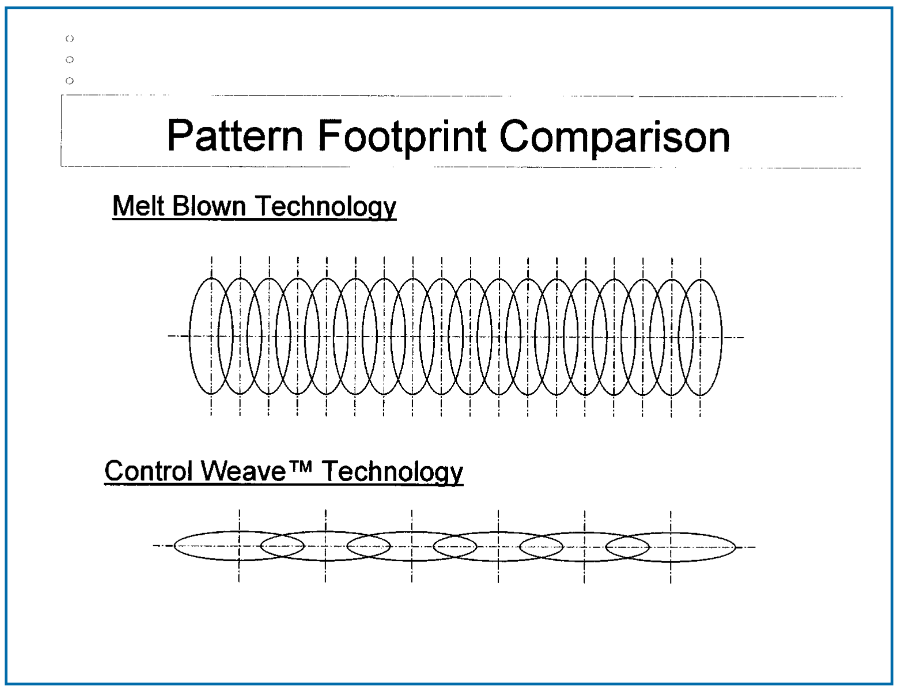


Figure 1: Pattern Footprint Comparison. *For a one-inch (25.4-millimeter) wide pattern, the number of nozzle orifices required is reduced to six by the Control Weave process design. This compares to the 15 to 20 nozzles per inch typically required by meltblowing devices.*

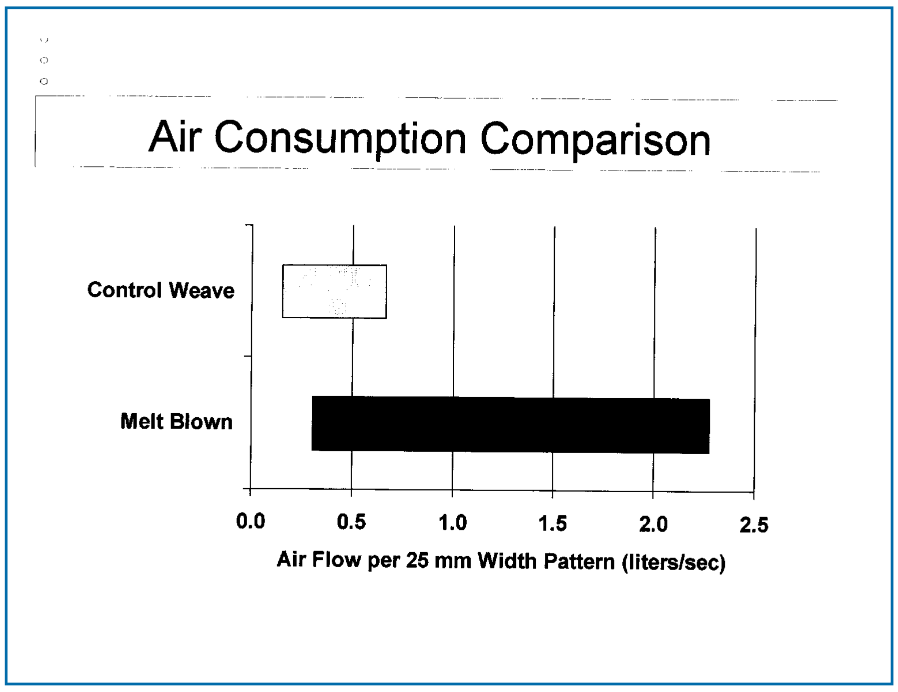


Figure 2: Air Consumption Comparison. *The Control Weave nozzle design reduces the amount of air required to create adhesive fibers when compared to the meltblown process. A full range of fiber sizes can be created without significant increases in the volume of compressed air supplied to the process.*

Getting Technical:

Bond Strength; Nozzle Design Make Control Weave Technology a Clear Winner!

A series of tests performed in Nordson laboratories analyzed and compared the peak bond strengths, flow distribution, air consumption and patterns of Control Weave and meltblown technologies. In the final analysis, the Control Weave process came out ahead.

High marks on bond strength. Adhesive is used to bond together various materials in a disposable product. However obvious this may seem, it is surprising how little emphasis has been put on evaluating the bond strengths of various patterns. At Nordson, we took the time.

A major objective in the bond-strength tests conducted at Nordson and reported here was to establish the relationship of the peel strength to various levels of both add-on weight and fiber size.

A common misconception is that by merely increasing the number of contact points, one can maximize bond strength. To maximize the number of contact points, the fibers produced must be as small as possible.

Nordson's bond-strength tests measured the peak peel strength of polyethylene and nonwoven laminations. Add-on weights were varied between 0.5 and 3.5 grams per square meter and produced at 150 meters per minute. The fiber size was also varied throughout the respective operating ranges.

Our results strongly debunked the myth that minimizing fiber size maximizes bond strength. Contrary to competitive claims, test results showed that larger fibers provided a stronger bond, regardless of add-on weight levels.

Figure 3, below, illustrates how different combinations of add-on weights and fiber sizes affect adhesive savings.

Clearly, the most economical operating point with any bond-strength requirement is at the largest fiber size possible. This operating point not only minimizes the amount of adhesive required, it also reduces the air consumed since less airflow is required to produce larger-sized fibers.

Break through nozzle design. There is a significant advantage for a die configuration to use fewer nozzles per pattern width, as with the Control Weave process. Fewer nozzles result in more flow per nozzle for a given add-on rate. Tests have shown that the greater the flow per nozzle, the less stream-to-stream variation is experienced.

Figure 4, below, shows how, with either technology, the variation decreases with higher flow rates per nozzle. As the nozzle-to-nozzle flow rates become more consistent, the pattern uniformity increases.

Because of the relative nozzle spacing differences of the two technologies, it takes an overall flow rate of approximately three times greater for the meltblown process to reach similar flow rates per nozzle as compared with Control Weave technology. However, even at the same flow per nozzle, Control Weave technology still yields higher consistency. This is because instead of drilled holes, precision stainless steel inserts are used, providing higher tolerance levels.

In sizing the internal diameter of a nozzle, there is a delicate balance between risking potential nozzle clogging and forfeiting the necessary hydraulic pressure to properly form fibers.

Increasing the diameter reduces the potential of nozzle clogging, but it reduces backpressure. With a lower nozzle density, as with the Control Weave technology, there is greater latitude in selecting the nozzle diameter. Also, with fewer nozzles, the overall flow area is reduced without having to significantly reduce the nozzle diameter.

Therefore, with the Control Weave technology, sufficient backpressure can be generated while minimizing the risk of nozzle clogging.

Placing nozzles farther apart has other benefits. Wider spacing greatly minimizes the potential for undesirable shot in the patterns.

It is now known that shot is the result of fibers becoming entangled during the formation process. It has been shown that the closer together the nozzles are, the more likely fibers are to become entangled. In addition, by positioning the air holes between the polymer outlets, a wall of air is formed that acts to keep the fluid streams separated until fully formed. This is proved by a comparison of the patterns generated by each technology.

For most applications, our tests demonstrated that using larger-sized fibers results in optimum performance -- bond strengths are maximized and overall operating costs, including both adhesive and energy costs, are minimized.

Control Weave technology aptly provides these optimal-sized fibers even at low add-on rates without polyethylene distortion or restriction of fluid transmission.

Its unique design delivers uniform, high-quality patterns over a wide range of operating conditions while providing a robust operation.

With its many refinements of the fiberization process, Control Weave technology truly represents a major advancement over meltblown technology for applying hot melt adhesive.

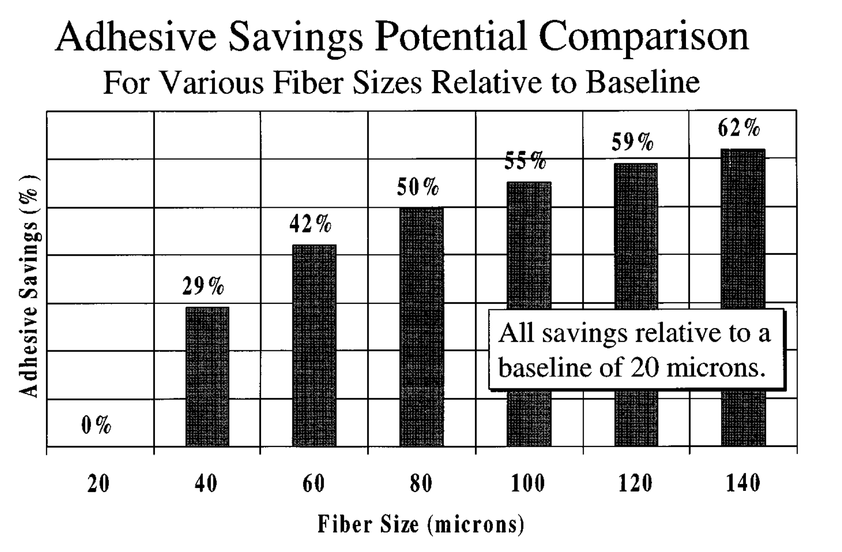


Figure 3: Adhesive Savings Potential. *The most economical operating point with any bond-strength requirement is at the largest fiber size possible. This operating point not only minimizes the amount of adhesive required, it also reduces the air consumed.*

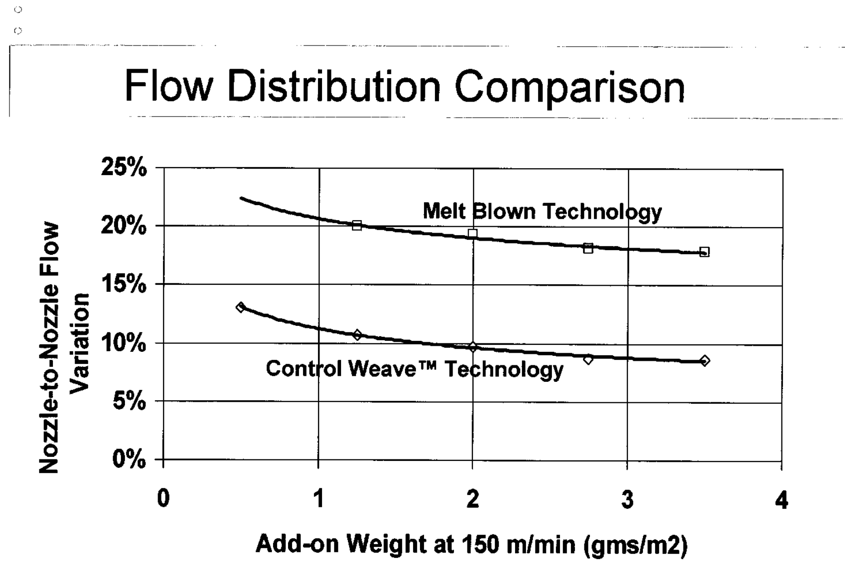


Figure 4: Flow Distribution Comparison. *Precision nozzle technology and higher adhesive flow per nozzle combine to yield improved flow distribution across the full range of application requirements. This improved flow distribution results in a more uniform and controlled process.*

Spray Method Comparison: Which One is Right for You?

Technology	Controlled Fiberization™	Control Coat®	Control Weave™
Pattern Description	Cyclodial fiber	Interlinked fibers	Woven fibers
Fiber Size (microns)	50 to 200	5 to 50	10 to 150
Fiberization Method	Air drag & centrifugal forces	Air drag forces	Air drag forces
Adhesive Outlets	Single round hole	Single slit	Multiple round holes
Air Outlets	Six or twelve round holes	Two slits	Two holes per adhesive outlet

Increasing Your Productivity: 'Quick-Change' Parts or 'Don't Change' Parts?

Beware! Some will try to sell you so-called quick-change or disposable parts. At Nordson, we know that the key to your success is productivity. The costs for individual replacement parts are much less significant than the downtime costs required to change those parts.

The difference in Nordson parts, when compared to these disposable parts, is measured in terms of products out-the-door and productivity on your machines. The results can be measured by counting the number of intermittent hot melt valves on your machine and referring to the following tables.

Nordson has a 35-year commitment to excellence in hot melt application systems -- a commitment to continuous improvement and industry-leading component life that pays off for you day-after-day and product-after-product.

Diaper Machine Example

Production Assumptions	Valve Replacement Assumptions	Intermittent Valve Assumptions
Diapers per minute: 500	Nordson valves: twice per year	Waistband elastic attachment: 6 valves
Hours of production per day: 20	Competitive valves: once per month	Leg elastic attachment: 2 valves
Days of production per year: 312	Time to replace each valve (including stopping the machine, relieving hydraulic pressure, replacing the valve, allowing the valve to reach operating temperature and restarting the machine): 15 minutes	Cuff elastic attachment: 2 valves
Total diapers produced per year per machine: **187,200,000 diapers**	Production cost per valve replacement: **7,500 diapers**	Cuff tack down: 2 valves
		Total intermittent valves: 12
		Total productivity benefit resulting from the use of long-life Nordson valves: **37,500 additional bags of medium diapers per year!**

Note: The above example is for illustration only. Actual results may vary.

Nordson

trends is published by the Nonwovens Systems Group of Nordson Corporation.

Send address corrections and correspondence to its editor, Carl Cucuzza, Nordson Corporation, 2905 Pacific Drive, Norcross, Ga., 30071, U.S.A. Telephone: (770) 497-3400. Facsimile: (770) 798-8200.

trends