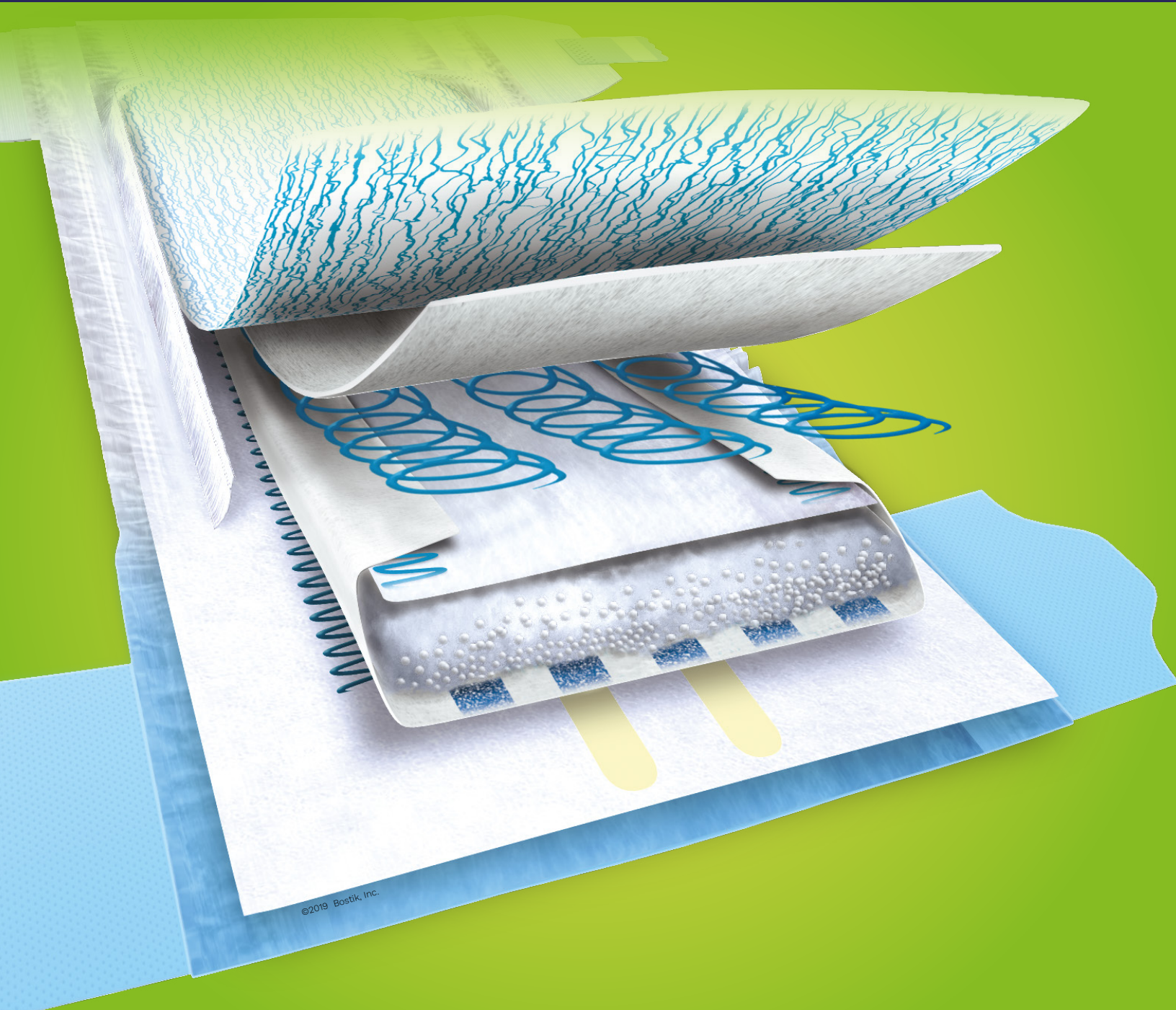




The Absorbent Core

IN SINGLE-USE HYGIENE PRODUCTS





The absorbent hygiene core is a complex topic, and never more so than today. Changing consumer needs drive innovation and as a result, new core configurations appear on the market. Each core seeks to meet consumer expectations for comfort, convenience, cost, and performance. And every step of the way, adhesives are there ... supporting core integrity ... creating channels ... stabilising the superabsorbent polymer (SAP) ... and so much more!

The right adhesives enable innovation in today’s absorbent hygiene cores.

TABLE OF CONTENTS

Executive Overview.....	4
Core Basics and the Adhesive’s Role.....	4
The Traditional Core: Updated and Still Going Strong	6
New Core Designs for the Next Generation of Diapers.....	10
Testing Core Performance and Integrity.....	12
Conclusion.....	14

Legal Disclaimer

Core Basics and the Adhesive's Role

EXECUTIVE OVERVIEW

Consumer satisfaction with your absorbent hygiene products depends on many things. Does it meet expectations? Does it hold up to the demands of daily life? Does it work well under pressure? Every material in a product is important, but the highest expectations lie with the core. It is, as its name implies, the very heart of the product.

This whitepaper is meant to improve understanding of the absorbent hygiene core in its many forms. The purpose of each component and the challenges of each design will be explored. The paper will also explain how adhesives help to build a better core and test methods used to ensure it performs as intended.

From baby diapers to items for adult incontinence and menstrual health, the absorbent hygiene article's core is its reason for being. Since their first introduction, the products' primary function has been to catch and contain bodily fluids. The core allows users (and parents) to go about their daily lives with confidence.

At the same time, the list of consumer expectations continues to grow, as do your product goals. Make it more absorbent. More comfortable. More discreet. And keep it from shifting or cracking because leaks are bad for business. It is easy to see why manufacturers are continually researching and experimenting with new core designs to stay competitive.

As products in the three market segments evolve, new challenges emerge. Understanding the key functions of common core systems is the first step in meeting user needs and exceeding expectations.

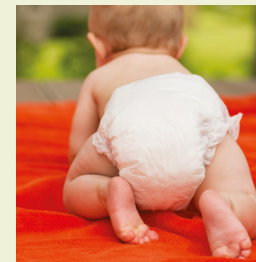
ACHIEVING THE RIGHT PERFORMANCE

There is no shortage of technologies involved with newer core designs in the absorbent hygiene market. Yet, however much they vary in structure, each core works to serve the same basic needs. Today, a top-performing core should:

- Attract and absorb fluid away from the skin
- Disperse fluid quickly throughout the product
- Prevent the feeling of a wet sensation after fluid is released
- Promote skin wellness by avoiding rewet
- Hold up to the stresses of daily life without cracking and leaking
- Ensure comfort by not shifting, bunching, or sagging during use
- Offer protection against noticeable odours
- Provide even the most self-conscious adult users with the discretion they desire

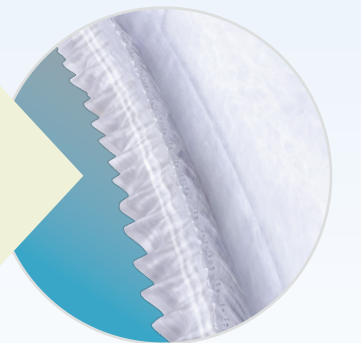
The most common cores today are the traditionally wrapped blend of fluff and superabsorbent polymer (SAP), the **channel core**, and the **compound/pre-compound core**. The different materials used in these cores are essential for achieving performance goals. A quality topsheet, which makes direct contact with the skin, assists with fluid acquisition after insult while helping to prevent rewet. The next layer draws fluid to the core where SAP absorbs and traps it.

Supporting the function of each of these core system components — and many others — is the adhesive. But every adhesive isn't created equal. Not every adhesive will work in every core design or every application within the core. That is why choosing the right adhesive can enable optimal performance and core integrity.



THE IMPORTANCE OF LEG CUFFS

Leg cuffs are not part of the core, but they are part of the overall diaper core system. The leg cuff acts as a physical barrier, so the fluff and/or SAP (superabsorbent polymer) contained in the core have time to absorb liquid. This is especially the case with channelling back any liquid that may be distributed off-centre and redirecting it back to the core area for acquisition.



The Traditional Core:

UPDATED, BUT STILL GOING STRONG

Since the introduction of SAP in the 1980s, most absorbent hygiene products have used the same type of core: a matrix of SAP and cellulose fluff. Compared to an all-fluff core, SAP could hold greater volumes of liquid, even under pressure. But SAP alone tends to wick fluid slowly, so fluff was still used to provide absorption speed and wicking.

The SAP/fluff matrix is typically contained by a topsheet, backsheet, and core wrap. Traditional cores generally contained more fluff than SAP. This appealed to customers who viewed more bulk as being softer and offering the best absorption. It is also a common solution to provide high absorption levels at lower costs for institutional healthcare. Even today, a core containing a mix of fluff-pulp and SAP remains the most common worldwide for baby diapers and medium-to-heavy adult incontinence products.

ADHESIVE'S 'TRADITIONAL' ROLE

The traditional core is the configuration many industry professionals find most familiar. The details may change, but the basics remain consistent. As we moved into the 21st Century, adhesives took on a bigger role, adding more value than ever before.

In traditional cores, adhesives are used to:

- Help prevent core shifting
- Hold the acquisition distribution layer (ADL) in place
- Stabilise the fluff/SAP (or SAP only) core matrix
- Seal the core wrap (if one is used)
- Bond materials to prevent shifting

Some cores use specific core adhesives; others employ multi-purpose formulations. Bostik's experts can help you determine what is right for your cores and products.

COMPONENTS OF THE TRADITIONAL CORE

TOPSHEET

This layer of the core system makes direct contact with the wearer's skin and enables the acquisition of fluid. It may also carry additives for skin health such as lotions, aloe, etc. The topsheet impacts the consumer's perception of product 'softness'. Adhesives bond the topsheet to the ADL. This helps prevent the core from shifting which could compromise absorbency and core integrity.

CORE WRAP

The primary function of the **core wrap** is to maintain core integrity during processing by containing the fluff/SAP matrix. It also provides stability during use. The type of wrap chosen can impact absorption and rewet. Adhesives seal the core wrap, bond with adjacent materials, and help prevent shifting.

BACKSHEET

The backsheet is a barrier that can be breathable or non-breathable. Polyolefin-based films are common. Adhesives may be applied to the backsheet to help prevent core shifting and leakage during use.

ACQUISITION DISTRIBUTION LAYER (ADL)

The ADL is designed to improve fluid management by creating a low-density 'void' space. This draws liquid quickly away from the topsheet and also serves to distribute the fluid for better absorption. Both assist with keeping skin dry and minimising leaks during rewet. Adhesives help anchor the ADL to the topsheet and core matrix.

FLUFF

Found at the centre of the traditional core, fluff aids with rapid absorption and distribution of fluid. It also assists with core integrity and improves core matrix stability. The amount of fluff used may be indicated by the ratio of SAP to fluff, such as 50/50 or 70/30. Typically made from tree cellulose, fluff can also be synthetic. Adhesives are used to stabilise the SAP/fluff matrix, especially as the amount of fluff is reduced.

SUPERABSORBENT POLYMER (SAP)

In traditional core designs, this polymer is combined with fluff to create the core matrix. It can also be used alone in newer, **fluff-free core designs**. While SAP absorbs and wicks fluid slowly, it can retain large volumes of liquid relative to its weight, even under pressure. Adhesives are needed to stabilise the SAP when less fluff is used.

WETNESS INDICATOR

Typically applied to the diaper backsheet in the crotch area, the wetness indicator is a functional adhesive that changes colour when wet. It is a common feature in many of today's disposable diapers as well as some products for adult incontinence intended for institutional use.

THE CHALLENGES OF REDUCING FLUFF IN A TRADITIONAL CORE

Making a thinner diaper is nothing new. Their average weight has been dropping for decades. Less bulky diapers are easier to store, stock on shelves, carry around, and fit inside clothes. For those living with adult incontinence, a more slender product also helps with discretion. Even the desire to be more sustainable can prompt reducing the number and amount of resources used.

One common method for going thinner is reducing fluff; some designs also increase the amount of SAP used. Instead of a core with a 50/50 SAP-to-fluff ratio, we have seen ratios of 60/40, 70/30, and beyond. As the balance shifts, it becomes clear how much fluff assisted with stabilising SAP within the core. This can lead to SAP shifting during normal wear, especially when it becomes heavy after insult. In some cases, core cracking and leaks can occur. Wet SAP without fluff to cushion it may also shift sufficiently to impact the product's comfort and fit.



50/50 – Fluff keeps the SAP in place and prevents SAP blocking. Core cracking is not usually seen.

70/30 – Typically requires a core wrap to contain the core matrix in production. Core cracking becomes common if an adhesive is not used.

80/20 – Adhesive is generally required for core production, as well as SAP immobilisation.



Fluff-free

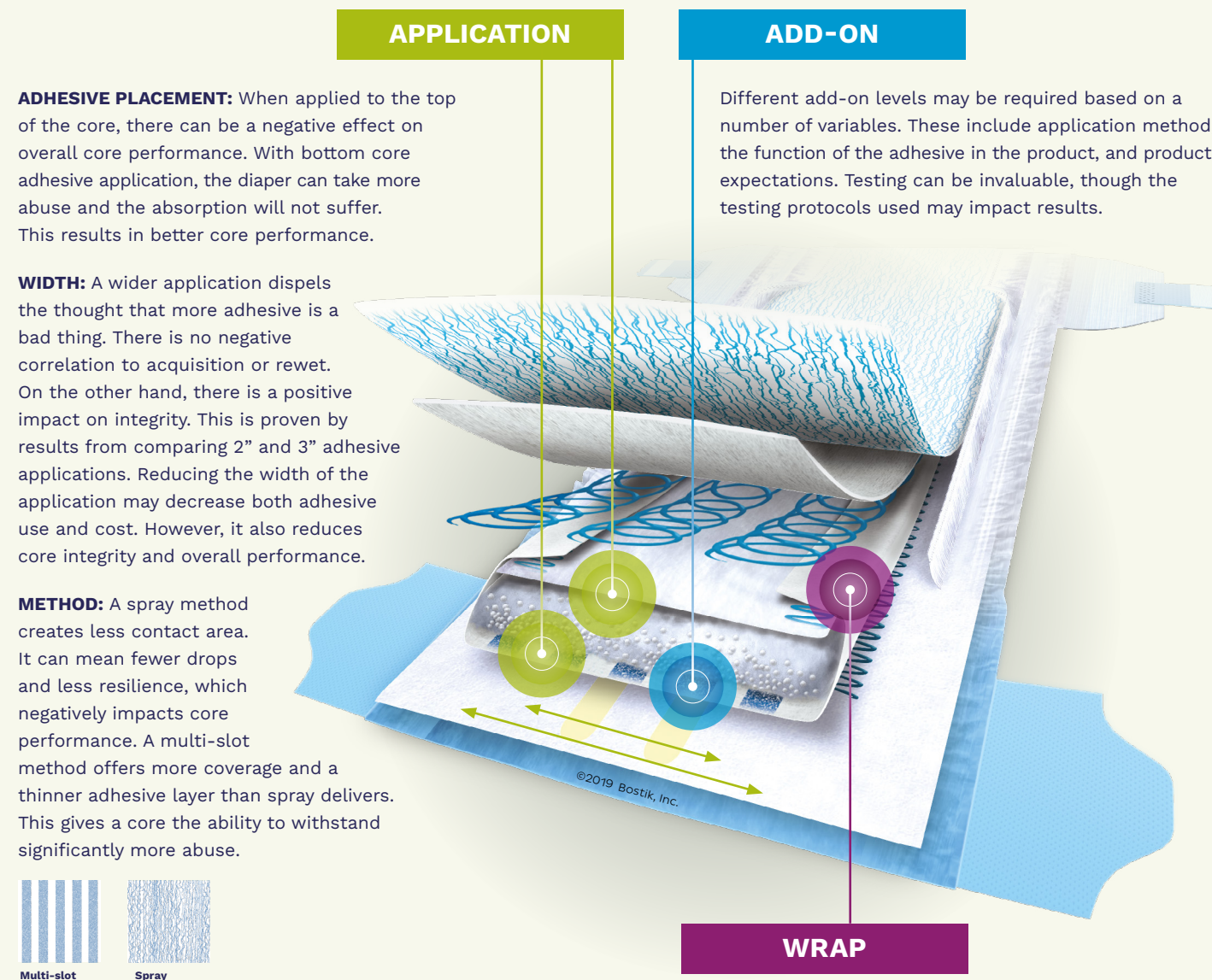
In fluff-free cores, the adhesive must have very specific attributes. They must:

- Immobilise the SAP without impacting wet integrity
- Enable SAP swelling
- Enable wicking
- Maintain core integrity

Considering a thinner core? Bostik's experts can help you choose the right adhesives for your absorbent hygiene designs.

GETTING THE MOST OUT OF YOUR ADHESIVES

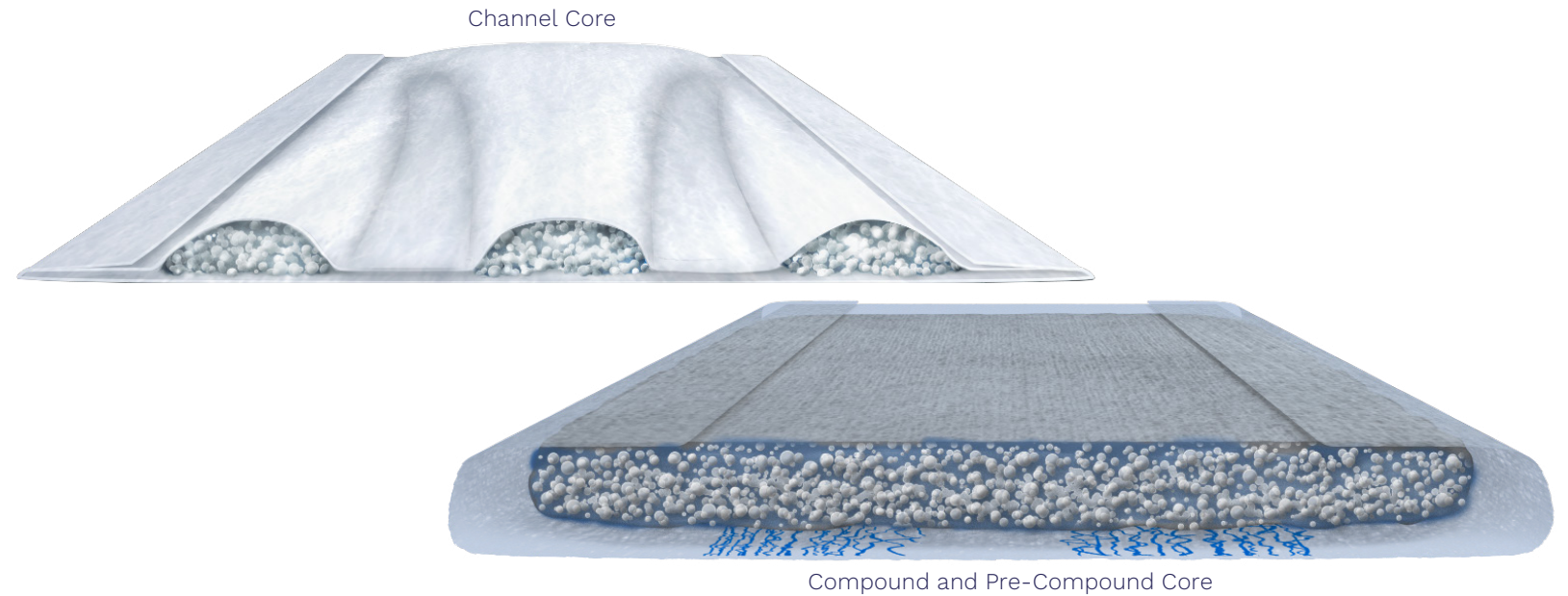
In today's market, superior leakage control is expected, even when cores are made thinner or without fluff. When a thinner core is made, it puts more demand on the adhesive used. With the goal of helping manufacturers build a dependable core, we take a look at three fundamentals of core design:



Bostik's core adhesive experts can help you select the best adhesive and application protocols for your particular designs.

New Core Designs for the Next Generation of Diapers

Faced with evolving consumer demands and the challenges of trying to modify the traditional core, manufacturers are exploring new options. Their goals are familiar: Improved core performance. Improved rewet protection. Skin wellness. Thinner cores that result in thinner products for comfort, discretion, and resource reduction. But for some manufacturers, the answer is innovation — new designs that change how we look at the absorbent hygiene core. The channel core is an excellent example, as is the compound/pre-compound core.



CHANNEL CORE DESIGN BASICS AND BENEFITS

Unlike a more traditional configuration, the channel core has longitudinal zones (channels) that are free of any absorbent material. These channels are formed by bonding the upper and lower core wrap materials together with adhesive.

Although mostly seen in baby care products, they have begun to cross over into adult incontinence articles for personal use.

The channels can be created through the use of a modified drum with elevated ridges and are typically limited to the crotch area. The absorbent materials are contained in tubular zones formed by these channels. These zones may contain SAP (superabsorbent polymer) alone, or SAP with fluff.

Benefits attributed to the channel core can include:

- Better core integrity and reduced risk of core cracking
- Better fluid circulation for better core utilisation
- Better air circulation for improved dryness and skin wellness
- Less bulking and sagging

MANUFACTURERS WORK TO FIND THE BEST CHANNEL CONFIGURATIONS

Most diaper producers have designed their channel cores to remain intact after insult. To achieve this, a designated channel core adhesive is recommended. As the SAP within the tubes absorbs liquid, it expands and puts extra pressure on the adhesive. To remain sealed, the channel adhesive must have a higher static peel.

Another common variation is in the number and shape of channels. There may be two, three, or even four channels. They may be straight or curved. We have also seen more complex channel configurations being used.

THE COMPOUND AND PRE-COMPOUND CORE

Another configuration that is gaining popularity, especially in Asia, addresses the same concerns in a different way.

The pre-compound core first emerged in the Chinese market and appealed to many consumers for its discretion and comfort. Using no fluff, the core is made by layering superabsorbent polymer (SAP) within layers of high-loft synthetic nonwoven fabric. A core adhesive is needed to hold all of these layers together and keep the SAP particles contained. As for the difference in names, compound cores are created inline. Pre-compound cores are prepared offline, before being moved in boxes or rolls to the production line.

The primary advantages of the compound/pre-compound core are:

- Thinner profile
- Excellent core integrity when wet
- Simplified production due to being fluff-free

THE CHALLENGE OF COMPOUND AND PRE-COMPOUND CORES

A primary concern of manufacturers using the compound core design is SAP loss. This can occur during production, which may be somewhat reduced by the use of adhesive. However, SAP can also shift within the nonwoven pockets, where the adhesive is not used. When the SAP shifts, it can create both clumps of SAP and areas where liquid can pass through without being absorbed.

For a closer look, read ['The Benefits and Challenges of Manufacturing the Pre-Compound and In-line Compound Core'](#).

Every adhesive does not work in every core, and consumer satisfaction depends on making the right choices for your product. Testing is a valuable tool to ensure that you have the right adhesive and settings to meet performance expectations.

Testing Core Performance and Integrity

There is no industry-wide testing standard to ensure that cores retain their integrity and perform as designed. Although manufacturers may use similar tests, the exact details may vary. Differences can include speed, time, and other specifics. Some use expensive equipment, whilst others rely on manual alternatives. Methods chosen may be a function of resources available, experience, or simple preference.

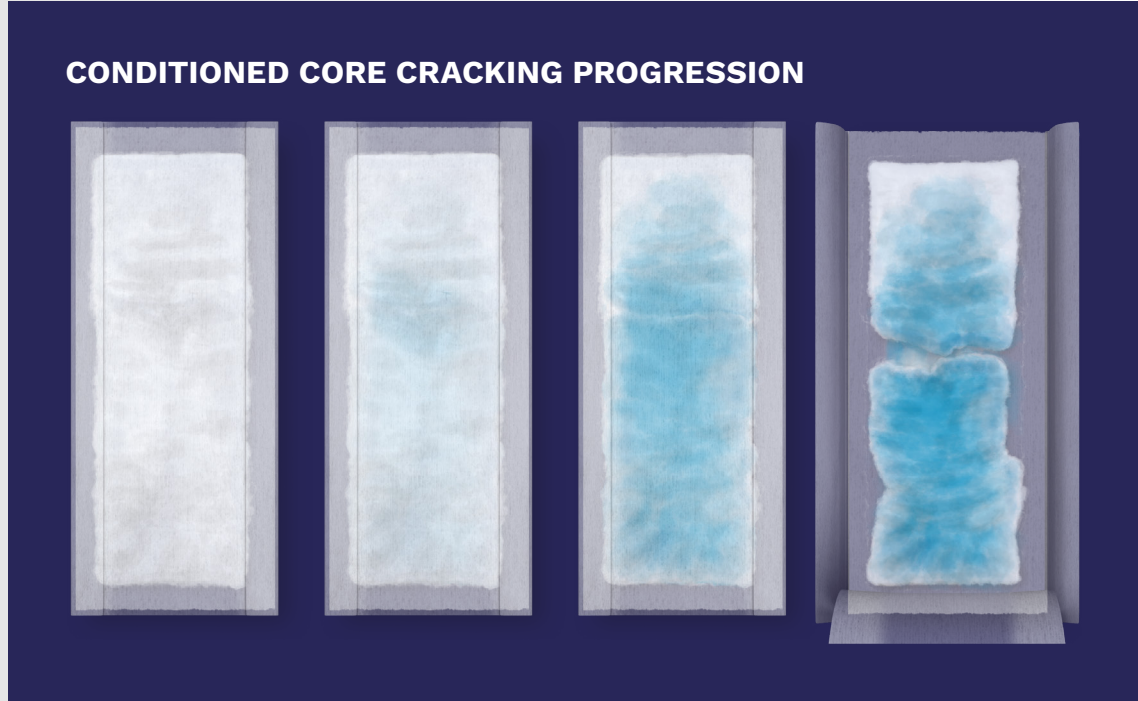
The following is an outline of typical methods used to test the core adhesive's performance. Other methods, such as absorption, retention, or rewet, can be used to evaluate overall core performance. At Bostik, we take a holistic approach to achieving and testing the desired impact of the adhesive.

ADHESIVE TESTING IN THE TRADITIONAL CORE

Although exact details may vary, certain types of evaluation are fairly common for the traditional core.

CORE CRACKING	VISUAL TEST FOR SAP/FLUFF REMAINS	WET PEEL
Qualitative test	Qualitative analysis	Quantitative test
After insult, the core is subjected to movement (typically some form of dropping, shaking, or spinning) until cracking is observed. May be performed manually or on a machine.	After insult, the core wrapping material is peeled back to observe retention of SAP/fluff. More retention indicates better wet strength.	Used to demonstrate the effectiveness of adhesive bonds when wet. A tensile tester records average peel after simulated insult.

Bostik's holistic approach means we continually look for ways to improve testing, especially opportunities to gain additional or more accurate information. Our [Conditioned Core Integrity test](#), for example, takes the typical core cracking test a step further. In addition to evaluating a fresh diaper, we add a preconditioned component to the procedure. This allows us to simulate the impact of a baby, toddler, or incontinent adult moving around before the insult occurs.



CHANNEL ADHESIVE TESTING: WILL IT HOLD OR RELEASE?

Because of their differing structure, core cracking is not a concern in channel cores. Instead, adhesive tests focus on the performance of the adhesive used to create the channels. This is necessary to ensure they perform as expected when the SAP absorbs insult and swells.

DYNAMIC PEEL TEST	IMMERSION TEST	CENTRIFUGATION TEST
Quantitative test	Qualitative test	Qualitative test
The top and bottom layers of a dry diaper are pulled apart at a consistent speed to determine the amount of force needed to separate the layers. This may be done under wet and dry conditions.	The diaper is immersed in a saline solution and allowed to absorb for a set period of time. (Typically, a 0.9% NaCl solution is used.) The diaper is then observed at set intervals to determine if the channels have broken open.	The diaper is immersed in saline solution, then centrifuged for a set period of time. The diaper is then observed to determine if the channels have opened.

COMPOUND/PRE-COMPOUND CORE TESTING

Manufacturers testing their early compound cores learned they rarely crack. However, they do have other weaknesses, which manufacturers have been working to improve. The primary aspects tested today include absorption (speed, volume, and rewet) and SAP loss/movement. These tests can also help determine how the adhesive can best be used to positively impact performance. We have found that using a variation on our [Conditioned Core Integrity Test](#) is useful in determining how much SAP shifts in use.

BOSTIK TESTING AND SOLUTIONS

Bostik offers a variety of informative tests to our customers which measure product performance and integrity. Take advantage of our additional [specialty services](#), such as [product audits](#). Our trained professionals will thoroughly test finished articles taken from your lines. We can also provide recommendations to overcome integrity and performance issues we find.

ABOUT BOSTIK HYGIENE

Bostik delivers smart adhesive solutions simply, consistently, and collaboratively, wherever you are in the world. Applying our deep understanding of the hygiene market, we enable the creation of sustainable absorbent hygiene products, improve consumer satisfaction, and bring value to your operational and business objectives.

ABOUT BOSTIK, THE ADHESIVE SOLUTIONS SEGMENT OF ARKEMA

Bostik, a subsidiary of the Arkema Group and a global player in specialty adhesives for the construction, consumer, and industrial markets, develops innovative and multifunctional sealing and bonding solutions that have been shaping our daily lives for over 130 years. With annual sales of around € 11.5 billion, a presence in some 55 countries, and 21,100 employees worldwide, the company is committed to meeting the major ecological, energy, and technological challenges through its innovations. It is focused on continuous improvement and operational excellence to meet the expectations of its customers and partners. www.bostik.com

CONCLUSION

Today's many types of absorbent hygiene cores are complex and intricate systems. That is why it is beneficial to seek the assistance of core experts early in the process. Bostik has extensive knowledge of both absorbent hygiene products and the adhesives they use. We take a holistic approach to helping you build the core—and the product—you envision. Exploring opportunities to improve performance, reduce cost, and enhance sustainability? We are here to assist you in choosing the right adhesives for your designs and help you remain competitive in the marketplace.



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